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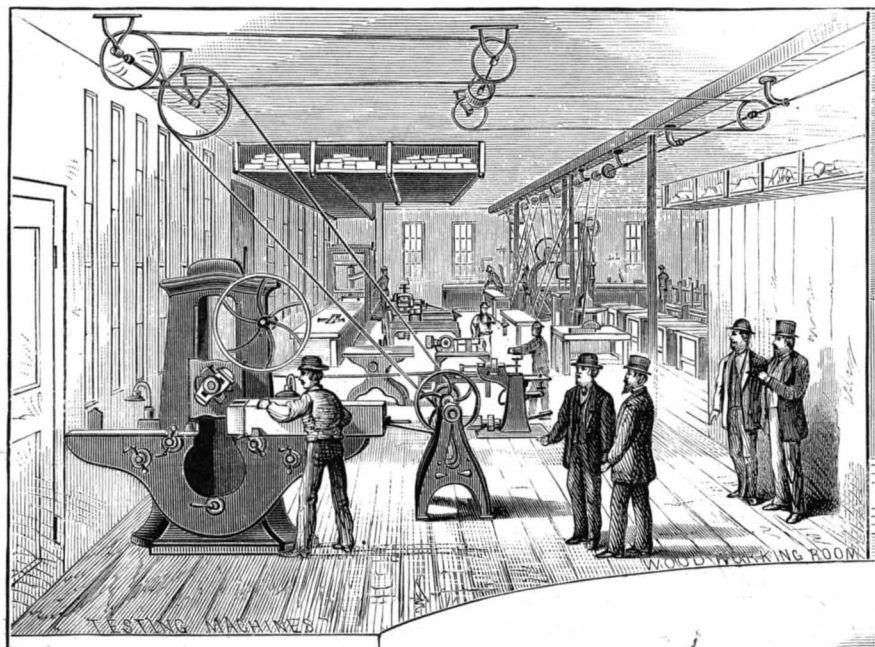


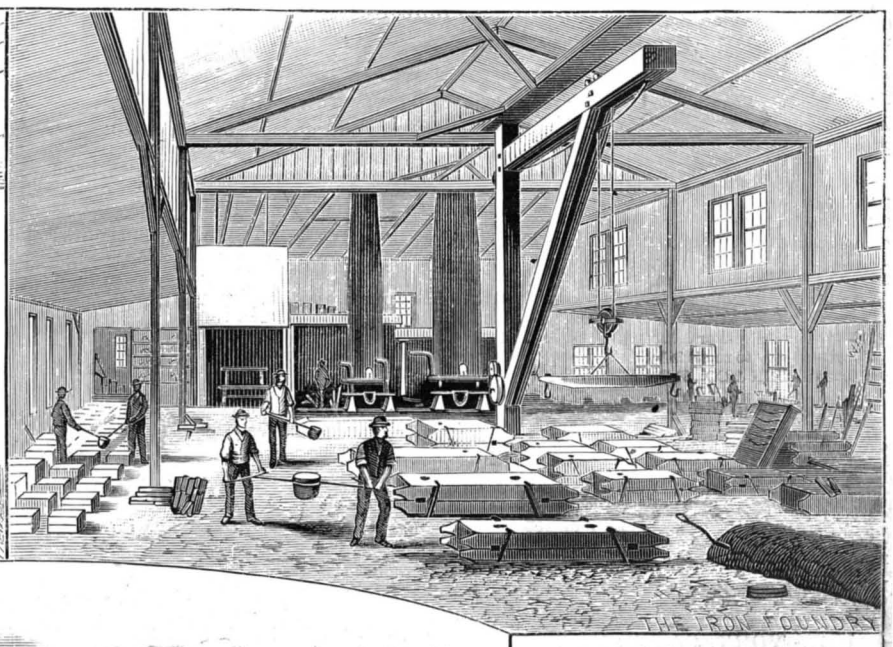


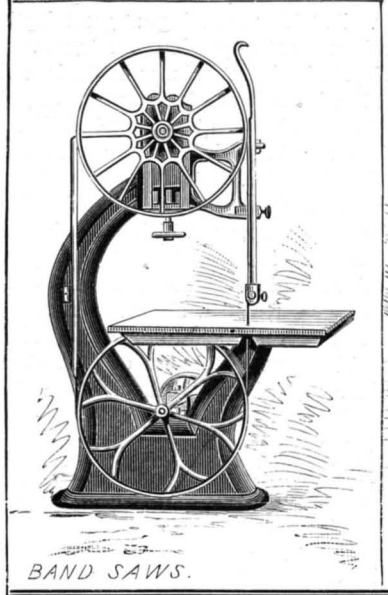
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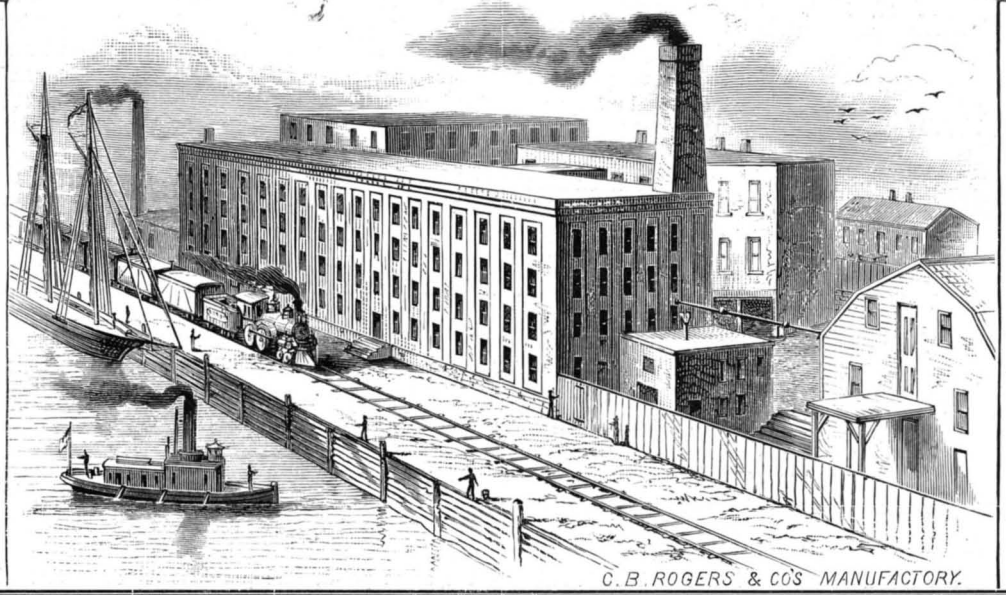
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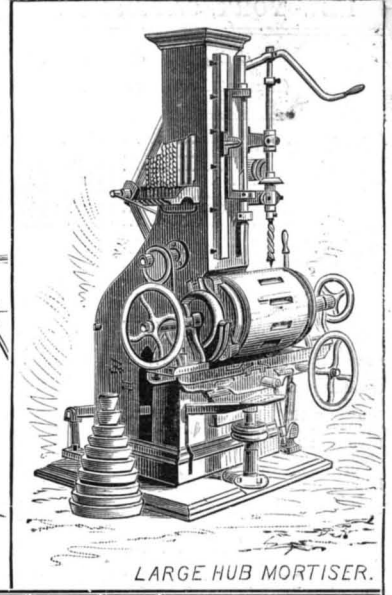
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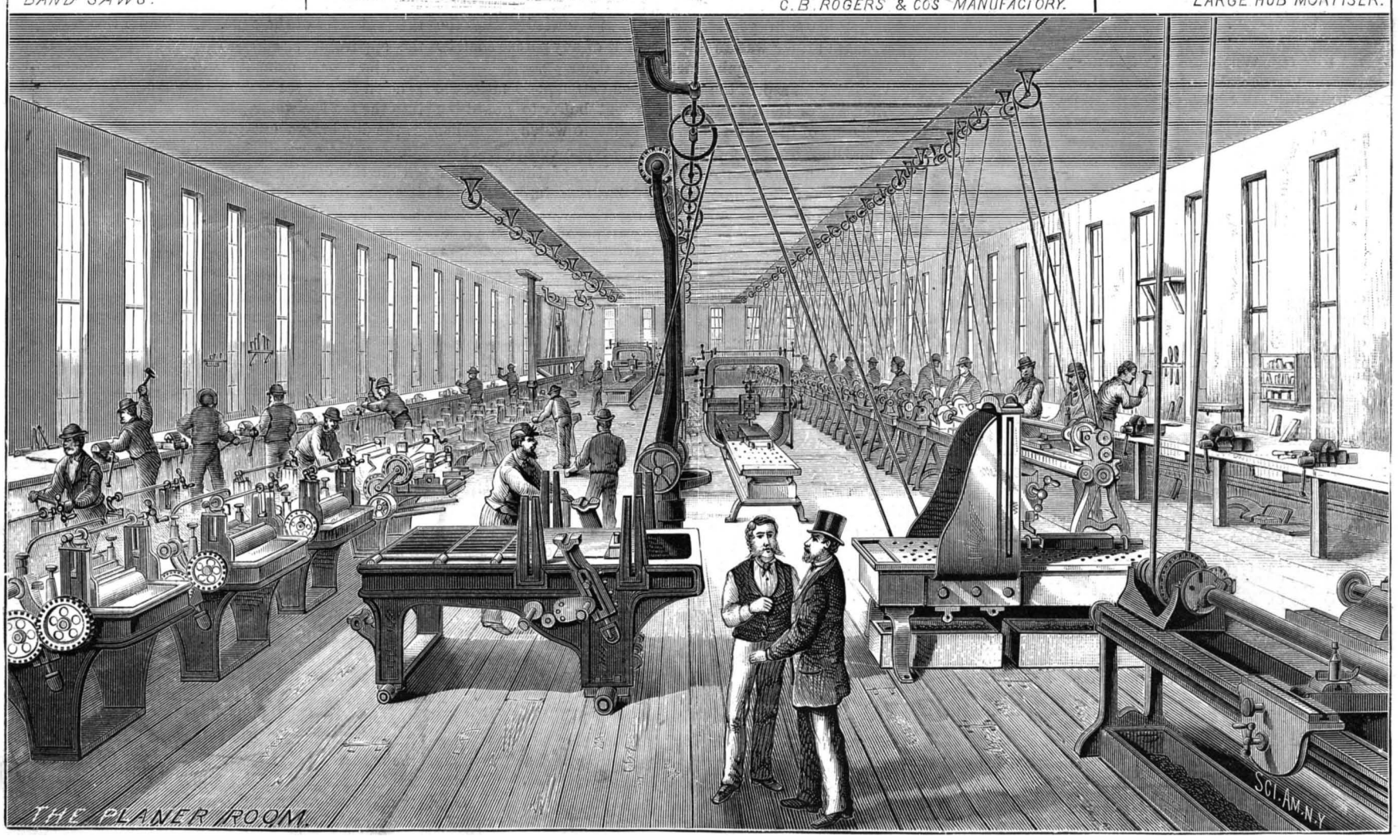


**THE MANUFACTURE OF WOOD-WORKING MACHINERY.—WORKS OF C. B. ROGERS & CO., NORWICH, CONN.**—[See page 37.]

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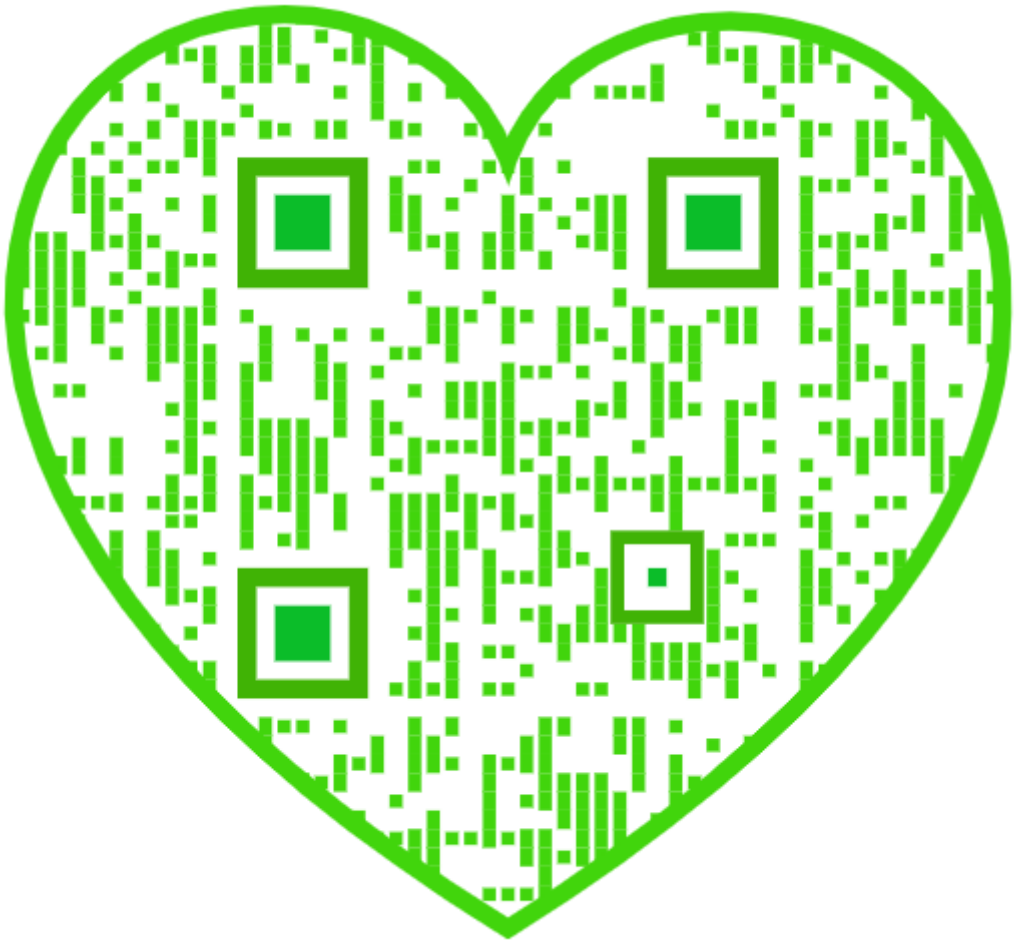

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## PATENT LEGISLATORS IN CONGRESS.

Last winter the enemies of inventors and patentees achieved a signal defeat in a general attack upon the patent system. Profiting by that experience, which taught them the futility of attempting by direct assault the destruction of a system so firmly grounded in popular esteem, they have scattered their forces this year for a sort of guerilla warfare, apparently hoping to do indirectly, under the guise of protection to oppressed grangers and the like, the work they failed to do a year ago.

We have before us four bills which prettily illustrate the spirit and the method of the guerilla system. They have been introduced in the House of Representatives by Mr. Baker and Mr. Colerick, of Indiana, and Mr. Converse, of Ohio, and are numbered respectively 2,631, 2,633, 2,913, and 3,049.

Of these Mr. Baker is sponsor for two. The first is designed to regulate the costs of suit in actions to recover damages for the infringement of patents; and provides that in cases where it shall appear that the defendant purchased in good faith and without actual knowledge of infringement, and applied the article to and for his own use and not for sale or for manufacturing a product for sale, if the plaintiff shall not recover a judgment in damages of twenty dollars or over, the court shall adjudge that he pay all the costs of suit, including a reasonable attorney's fee to the defendant; and if the plaintiff shall not recover a judgment in damages of fifty dollars, or over, the court shall adjudge that he pay all the costs of suit.

The propriety of thus punishing the patentee for defending his property rights will be apparent to all who desire to appropriate his property to their own use. The justice of such discrimination in favor of offenders against patent rights solely, however, may fairly be disputed by all the other classes of thieves and plunderers and receivers of stolen property.

Properly named, the bill would be entitled "a bill to facilitate the infringement of patent rights, and to encourage patent litigation." Since a very large portion of all patented articles and processes are intended for individual use, and not for the manufacture of articles for sale, and since damages for individual misappropriation in such cases are apt to be small, the infringer has everything to gain and nothing to lose in standing suit, while the inventor is bound to sue or practically abandon his rights.

But the advantage thus aimed at is not enough to suit Mr. Baker or his employers. Accordingly he hands in another bill to limit the liability of purchasers to actions for damages in cases of infringements. This bill is short enough to quote entire. It provides "that no suit shall be brought or maintained in any court having jurisdiction in patent cases for any alleged infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant, or any person through or from whom he derives title thereto, purchased the same in good faith from the manufacturer thereof, or from any person or firm engaged in the open sale or practical application thereof, and applied the same to and for his own use, and not for sale, nor for manufacturing a product for sale."

Mr. Colerick's bill aims at the same point, and provides that purchase in good faith without knowledge that the purchased article was an infringement of any patent shall be a complete defense against action for damages.

In their best aspect these bills are an attempt to make the United States Courts a sort of patent buffer to guard the purchasers of illegal articles, or articles to which the seller has no title, from the natural and proper consequence of their ignorance and folly. The propriety of thus discriminating in favor of one phase of business imbecility and against one particular class of property owners is as little apparent as is the need of it. The proper way for the complaining farmers to protect themselves against patent swindlers is to buy patent rights and alleged patented articles as they do horses and lands and other property, only after making sure that the seller's title is good. If they will take the risk of buying blindly let them abide the issue manfully, and not call upon Congress to throw the consequences of their folly upon the shoulders of rightful owners who have had no part in the fraudulent sale.

But these bills present a much less tolerable aspect. Ostensibly they are put forth to meet a special class of cases in which innocent farmers are said to be the victims of patent sharps. Really, we believe, they are intended to break down the defenses by which inventors are now enabled to guard their constitutional rights under the patent laws; and in case they are passed they certainly will have the effect to destroy absolutely and utterly the value of a large class of patent rights.

For example: A, in Maine, invents and patents a device calculated to lessen the cost or increase the safety of railway construction or operation. The foreman of a railway company's shops in Indiana offers the invention as his own to the company which employs him. They buy it and use it. In course of time the inventor hears of the infringement and brings suit. After such delays and multiplications of court expenses, as powerful corporations are so well able to effect, the case comes to trial and the defendants raise the plea that the purchase was made in good faith, for their own use, and not for sale or for manufacturing a product for sale. The defense is complete; the plaintiff gets no damages, and besides suffering the loss incident to the invasion of his rights he has to pay all the costs of the suit and a "reasonable" fee to the railway company's attorney. An admirable issue, truly, for a patent law designed for the advancement of the useful arts, by the encouragement of inventors!

But Messrs. Baker and Colerick are mere bushwhackers compared with Mr. Converse. The latter gentleman enters the lines of the patent defenders, ostensibly in friendship, and quietly drops a match into the magazine, hoping thereby to blow up the entire system. In this way:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That it shall be unlawful for any owner, or part owner, or assignee of the whole or any part of any patent granted or pending under the laws of the United States to charge or receive as royalty on such invention or discovery more than an amount equal to the cost of production, and twenty-five per centum to be added thereto for profits of manufacture in addition to such cost, and twenty-five per centum profit. Whenever the invention or discovery or the article patented, or when patent is applied for, is used for hire instead of being sold, it shall be unlawful to charge or receive for such use more than the royalty, cost, and profit of manufacture aforesaid. *Every owner or part owner, by assignment or otherwise, of any patent heretofore or which may hereafter be granted, or for which application is pending under the laws of the United States, shall forfeit to the public all right to said discovery or invention.*"

That is all; and it is certainly quite enough. At first sight it may seem as though some specific offense should have been named in the final clause. But that is not at all necessary. The act of applying for a patent for an invention is offense enough, in the eyes of men like Mr. Converse and his anti-patent associates, to justify the forfeiture of all right to the invention; and Mr. Converse is to be commended for frankly and boldly stating precisely what the would-be patent law amenders are driving at.

## A NEW DEEP SEA SOUNDING APPARATUS.

We have received from the author, Sr. Henrique de Lima e Cunha, a copy of a paper recently read by him before the Lisbon Academy of Sciences on the subject of a new deep sea sounding apparatus devised by him, and which appears to have some valuable features, in addition to possessing the merit of novelty. In taking soundings at great depths, and in places where there are strong undercurrents, no very great exactitude can be attained by ordinary methods, owing to the fact that the line is carried off by the undertow, and the length paid out does not represent the vertical distance to which the weight has descended. The apparatus under consideration is based on the effects of atmospheric pressure. It consists of a cone of sheet copper, having for its base a diaphragm of the same metal, and which screws into the bottom of the cone so that it may be readily removed when necessary. In this movable base there are six small holes, one millimeter in diameter, which allow the ingress of the sea to the interior of the cone; and to the center of its upper surface there is soldered a vertical wire of pure silver, two millimeters in diameter, and which occupies the axis of the cone.

To prepare the apparatus for use the silver wire is moistened with nitric acid, which results in the production of a thin film of nitrate of silver. The base being screwed on, the cone is suspended by means of a ring at its apex, and sunk by means of two separate weights or stones suspended by cords or chains depending from three rings attached to the perimeter of the cone. To insure a vertical position to the apparatus and to prevent it from being easily turned from its course, a small float is attached just above the suspension ring at the apex of the cone. As the apparatus sinks into the sea the water penetrates into it through the orifices in the diaphragm and gradually rises in proportion as the pressure increases during the descent. The salt water acts on the thin coating of nitrate of silver on the wire, and turns it perfectly white by the production of chloride of silver as far as immersion has taken place. By this means, therefore, is determined to what height the water has risen in the cone, and consequently what the pressure has been; and from these data the depth to which the instrument has descended is easily determined by simple formulæ. The author suggests that by suspending the lower weight by means of an apparatus which would detach it on striking bottom, the apparatus would ascend to the surface of itself, thus dispensing with the use of a line.

## PROSPECTS OF TRADE IN BRAZIL.

The picture of a sturdy negro carrying a wheelbarrow on his head would not be a bad symbol of the force of custom which, in an infinite variety of ways, labor-saving inventions have to overcome in most parts of the world. Our consul general at Rio Janeiro says in his recent annual report that a negro so employed had lately been seen by him in the streets of that city. The rarity of good roads in tropical countries has led to a general custom of carrying burdens on the head; and even with good wheeling provided the handy wheelbarrow was to the Brazilian porter only so much additional burden.

The overcoming of such deep-rooted and stupidly-followed customs is one of the main tasks to be performed in building up any considerable trade with foreign, more especially tropical countries. For this work the commercial agent and the manufacturer as well needs know by personal study what are the customs of the people he wishes to trade with, how to adapt his wares with the least change to meet their wants, and to avoid sending wares which cannot by any possibility be made available.

In the report referred to Mr. Adamson says that his office is inundated with letters of inquiry, many of them asking

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for information which any school geography or the nearest public library could furnish. He then goes on to describe conditions of Brazilian climate, productions, social customs, and the like, which make it impossible for many articles of American manufacture ever to find a market there, pointing out at the same time several lines of manufactures which, by proper management, might be sold largely in that part of the world.

A particularly suggestive and valuable part of the report will be found in the comparison made between the methods of German commercial agents and merchants and those of our own country. The mercantile training of the former embraces not only all the details of office work, but a thorough knowledge of geography and of the products of every land, of mercantile law, and of at least two languages besides their own. The first business of the German agent is to master the language of the people he is to trade with, if he has not already acquired it. Similar qualifications are the exception among the ambassadors of American trade. The majority of them have to employ an interpreter to make their business known, and the interpreter can rarely speak so as to compel attention and belief. Under such unfavorable conditions it is not surprising that American agents in Brazil are apt to be less successful than those of German houses. On the other hand, manufacturers of goods suited to the Brazilian market, who have intrusted their business to competent agents, have been very successful.

Speaking generally, Mr. Adamson says that if the present business of an American manufacturer will warrant his spending a thousand dollars to study the Brazilian market, he should personally visit Rio Janeiro to see for himself whether his wares are adapted to the wants of the people, or whether they can be altered to suit that market. If these questions find an affirmative answer he should establish a live man from home as his agent in Rio Janeiro, with capital to tide over the first few months. In the case of American stoves it took years to get them introduced and teach the people how to use them; but with industry and perseverance the field was won, and a large demand for the article is certain. In like manner our sewing machines have made for themselves a splendid market in Brazil.

In this connection Mr. Adamson's statistical report of the trade of Brazil with different countries, the lines of steamships plying between Brazilian and foreign ports, and so on, will be found especially valuable.

## NEW METHOD OF PRODUCING PHOTOGRAPHIC PICTURES IN COLORS.

At a recent meeting, in Paris, of the Photographic Society of France, M. Bonnaud exhibited specimens of his new system of colorization, which attracted much attention. The process is as follows: A negative is taken in the usual manner, from which as many prints on paper are made as there are to be colors in the finished picture. If, for instance, it is a portrait of a lady, to be furnished in four colors—blue, orange, red, and green—four paper prints are made. From one of the prints all the parts that are to have the same tint are carefully cut out; for example, the lady's dress and the sky, which are to be blue, are cut out; from the next print the trees and grass are cut out, as these are to be tinted green, and so on. The cut prints being arranged to "register" are now to be used as stencils, and are successively laid upon a sheet of paper and colors thereto applied, through the stencils, by means of a brush—an operation which requires little skill and may be done by girls. The paper with the stenciled figure upon it, in the different colors, is now albumenized and then sensitized in the usual manner in the photo bath; after which the original negative is applied and a photo print made upon the sensitized colored sheet, then developed and toned as usual. Photographs thus made are said to be attractive, the gradations of light and shade in the colors being excellent, and the effects very pleasing.

The process is simple, costs but little, and the pictures, it is said, may be rapidly produced. Where large numbers of the same colored picture are ordered stencil plates are made in sheet brass, the parts taken from the paper print being used as patterns to cut the brass.

## THE TAY BRIDGE DISASTER.

The most appalling of railway disasters occurred on the evening of Dec. 28, at the bridge over the Frith of Tay, on the railroad between Edinburgh and Dundee, Scotland. At this point an iron bridge two miles long crosses the Frith on 85 spans, ranging from 18 to 88 feet above the water. Of these spans, six were 27 feet, fourteen of 67 feet 6 inches, fourteen of 70 feet 6 inches, two of 88 feet, one of 162 feet, one of 170 feet, and thirteen of 245 feet. The long spans near the center of the bridge were the highest above the water.

On the evening of the disaster a train from Edinburgh to Dundee, comprising locomotive and tender, four cars of the third class, one of the second, and one of the first class, and a brakeman's van, entered upon the bridge near seven o'clock, a high wind blowing at the time.

In the bright moonlight the train was seen to reach the middle of the bridge over the navigable part of the Frith, then, suddenly, with a flash of fire it disappeared. Subsequent examination found that a section of the bridge half a mile in length, comprising a dozen or more of the longer and highest spans, had fallen, and the train had been precipitated into the gulf. The railway officials report that the falling girders made a very clean break from that portion which remains standing. Almost the only signs of the catastrophe are in the ends of the rails where they were torn asunder. The rails remaining appear wrenched out of their chairs for a few yards.

For some hours the furious gale prevented boats from reaching the scene of the disaster. By that time no vestige of the wrecked train could be found; and for a long time divers were unable to discover any traces of it in the quicksands of the bed of the Frith.

The first report of the managers of the railway said that there were nearly three hundred passengers on the train besides the train-men. Not one survived. Later the authorities estimated the loss as low as seventy-five. The exact number will probably never be known.

It is impossible at this writing to obtain any clew to the cause of the disaster. The gale is said to have been the severest experienced in Scotland since 1868. It is most probable that the bridge was blown down. That its fall was occasioned by a derailment of the train by the wind, does not seem likely in view of great length of bridge destroyed. That the foundations of the piers were not undermined seems probable from the circumstance that one report speaks of the piers as still visible. Whatever the cause, the disaster remains the most remarkable and terrible in the annals of railroading.

A detailed account of the construction of the fatal bridge, with illustrations, was printed in the SCIENTIFIC AMERICAN SUPPLEMENT of April 7, 1877, and an account of the completed structure and its inauguration in the SUPPLEMENT for July 20, 1878.

## OUR VENOMOUS SNAKES.

The danger from venomous snakes in the United States, though small as compared with that in warmer countries, is none the less real; and the destruction of such snakes should always be encouraged. But unfortunately the popular notion of snakes, instead of making venomous species the exceptions, makes them the rule. This erroneous notion, coupled with a natural and perfectly proper feeling that no opportunity of destroying a dangerous reptile should be neglected, deals havoc alike to the harmful, the neutral, and the useful of serpent-kind.

Of course such a wholesale war entails the destruction of many serpents that are not only harmless but useful. And in this connection it may be worthy of notice that non-venomous snakes, which commonly attain a length of but twenty inches or less, subsist chiefly upon insects, worms, etc., and should be regarded as friendly to the interests of agriculture.

A generally available means of determining at sight whether a snake is venomous or harmless is therefore desirable.

As a general rule, the venomous snakes have thick bodies and broad, triangular heads, which they flatten when they wish to assume a threatening aspect; while the innocuous snakes have slender bodies and narrow heads, which they do not flatten. This rule is often laid down as a sufficient guide in this matter; but it is far from reliable. We have venomous species of colubrine form and of mild disposition, as well as innocuous species with the viperine form and habits.

Nor is there known any infallible external criterion of the nature of a snake. Even the herpetologist, upon discovering a new and apparently harmless species, cannot with certainty pronounce it to be harmless from its external appearance alone.

In order, therefore, to improve every opportunity of destroying those which are venomous, and at the same time to encourage those which are innocent, an acquaintance with some of the more obvious specific characters of certain serpents is indispensable. But if we inquire into the matter, we shall see that the number requiring such an acquaintance is very small.

In North America, including Lower California and Sonora, in Mexico, there are one hundred and thirty-two species of snakes. Of these twenty-two, or exactly one sixth, are venomous. (The ratio of one to five, however, should by no means be taken as the numerical ratio of the venomous snakes to the harmless, since the former are far less numerous individually than specifically.)

It is plain that an acquaintance with the twenty-two venomous species renders a knowledge of the one hundred and ten harmless species unnecessary. But sixteen of the twenty-two are rattlesnakes—belonging to three different genera, it is true, but for our present purpose merely rattlesnakes, since all possess rattles. The nature of the rattle is so well known in districts where these snakes occur that no description of it is here called for; and as this organ is so conspicuous, rendering the rattlesnakes easily distinguishable, these may be stricken from the number of venomous serpents whose recognition requires their specific acquaintance.

Of the six remaining species, two offer well marked varieties, a knowledge of whose appearance is important. We thus have but eight "kinds" of serpents requiring for their immediate recognition as venomous a knowledge of their form and markings.

But except for those whose pursuits lead them over widely separated localities, it will be unnecessary to know the appearance of even this small number. From one to three of them only will be found in most parts of the United States. In the region west of the Sierra Nevada not one of them occurs, the venomous serpents being represented by rattlesnakes alone. In the Northern States there is but one, the copperhead. In the mountainous districts of North Carolina and Tennessee four of them may be met with.

Now, as to the method of obtaining a practical distinguishing knowledge of these few snakes. Let advantage be taken of the first opportunity of killing a snake suspected to be one of them. If, by the presence of the "pit" or of fangs, it is determined to be venomous, note carefully such peculiarities of markings and form as may be most readily observed in other specimens of the same when seen alive in their native haunts. The specimen should then be preserved in spirits, so as to be available at any time for comparison with harmless species to which it bears a superficial resemblance.

Our venomous snakes, exclusive of the rattlesnakes, are comprised in two genera, *Ancistrodon* and *Elaps*. In either genus there is but one pair of fangs—long, slender, recurved teeth, situated in the forward portion of the upper jaw. In the genus *Ancistrodon* the fang is concealed in a fold of the gum, so that it is unsafe to presume upon its absence from a mere inspection. It must be pried out into sight by some sharp-pointed instrument. In this examination the greatest care should be exercised, as the venom continues to be secreted for some time after the death of the reptile, and a wound from the fang would probably at any time cause severe inflammation, if nothing more serious.

The fangs in the genus *Elaps* are permanently erect, smaller, and situated further back than in *Ancistrodon*.

The "pit," above mentioned, is a small cavity about midway between the eye and the nostril, and a little below the line joining them. While not common to all venomous snakes, it is seen only in those which are venomous; so that its observance will often obviate the necessity of looking for fangs.

To those who lack time for gaining such a practical knowledge of our serpents, the following fact in regard to them may be of interest. All snakes of uniform color upon the upper surface of the body, or marked with longitudinal bands or stripes, are innocuous. F. W. CRAGIN.

### Long Distance Telephoning.

An interesting trial was made with Bell telephones, Dec. 26, between Dayton, Ohio, and Indianapolis, Indiana, a distance of 108 miles. The wires of the American Union Telegraph Company were used, and the experiment proved conclusively the utility of Bell telephones for distances within 100 miles. Conversation between the exchange offices of the two cities was maintained throughout the day. A circle of 100 miles radius, with New York as a center, includes all the western part of Connecticut as far as New Haven, with its numerous large and growing towns and cities; the Hudson River cities as far as Hudson, taking in Poughkeepsie, Newburg, Sing Sing, and other large places; all the cities and towns of New Jersey; Wilmington in Delaware; and Philadelphia, Reading, Easton, Scranton, and other large places in Pennsylvania. A slight addition to the radius, still without much exceeding the distance between Dayton and Indianapolis, includes Hartford on the northeast and Baltimore on the southwest. All these great centers of population and trade are thus already within possible telephonic reach of New York; and it is quite within the limits of possibility that the end of the current year may see business men in this city dealing directly, by word of mouth, with customers scattered over all this wide reach of country.

### South American Exhibition.

The United States Consul at Buenos Ayres, in a dispatch to the Department of State, dated October 21, 1879, announces that a Continental Exhibition will be opened in that city on September 15, 1880, to continue until December 15 of the same year. The Exhibition is to be divided into six sections. All the nations of South America can contribute to and compete in the Exhibition; but the United States and Europe are limited to one section for machinery only. This section is divided into eleven groups, consisting of hydraulics, mining, metals, casting of types, bookbinding, agricultural implements, and several other groups. The usual directions to exhibitors have been published in pamphlet form.

### Goods for the Melbourne Exhibition.

Mr. Thomas R. Pickering has been named by the Secretary of State, at Washington, as agent for the United States Government to solicit exhibits for the Melbourne Exhibition, to begin October 1, 1880. Mr. Pickering's office is in room 102, Post Office Building, New York city, where information in regard to the Exhibition can be had. The United States will not assume the expense of shipping goods, but will, through their commissioner, receive goods at Melbourne, find them place in the Exhibition buildings, and publish a list of the exhibitors.

### Cactus Fiber.

A species of dwarf cactus abundant in Lower California is rich in fiber, said to be excellent for mattresses. It is reported that an experimental machine, costing only $400, converts the raw material into white, elastic fiber with great rapidity, and promises to reduce the cost and improve the quality of such goods very materially.

### How Connecticut Manufactures are Booming.

We learn that the Wheeler & Wilson Sewing Machine Company, of Bridgeport, Conn., has at present on hand orders for ten thousand sewing machines in advance of the capabilities of their immense establishment.

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### EDISON'S VACUUM APPARATUS.

With the exception of the peculiar carbon used by Mr. Edison in the construction of his lamps, there is nothing of more vital importance in the development of his system of electric illumination than the apparatus employed to exhaust the air from the little globes containing the carbon horse-shoes, for upon the perfection of the vacuum depends the success of the lamp.

Since Otto Von Guericke invented the air-pump in 1650 it has been the subject of various modifications and improvements; but the most perfect forms of piston air-pump yet devised are incompetent to produce the degree of exhaustion demanded by modern experimenters.

In vacuum apparatus, as in most things connected with scientific investigation and experiment, the simplest means and methods prove the best. It seems that in the natural course of invention, simplicity is the latest feature attained. Air-pumps and vacuum apparatus form no exception to this general truth. The most recent as well as the most perfect air-pumps consist essentially of a glass tube and a column of mercury. Two forms of mercurial pump are used by Mr. Edison in removing the air from his lamp bulb; one for exhausting the greater volume of air, the other for perfecting the vacuum The first is the invention of Geissler; the second, of Sprengel. The engraving shows the arrangement of these pumps in connection with the McLeod gauge, and other accessories.

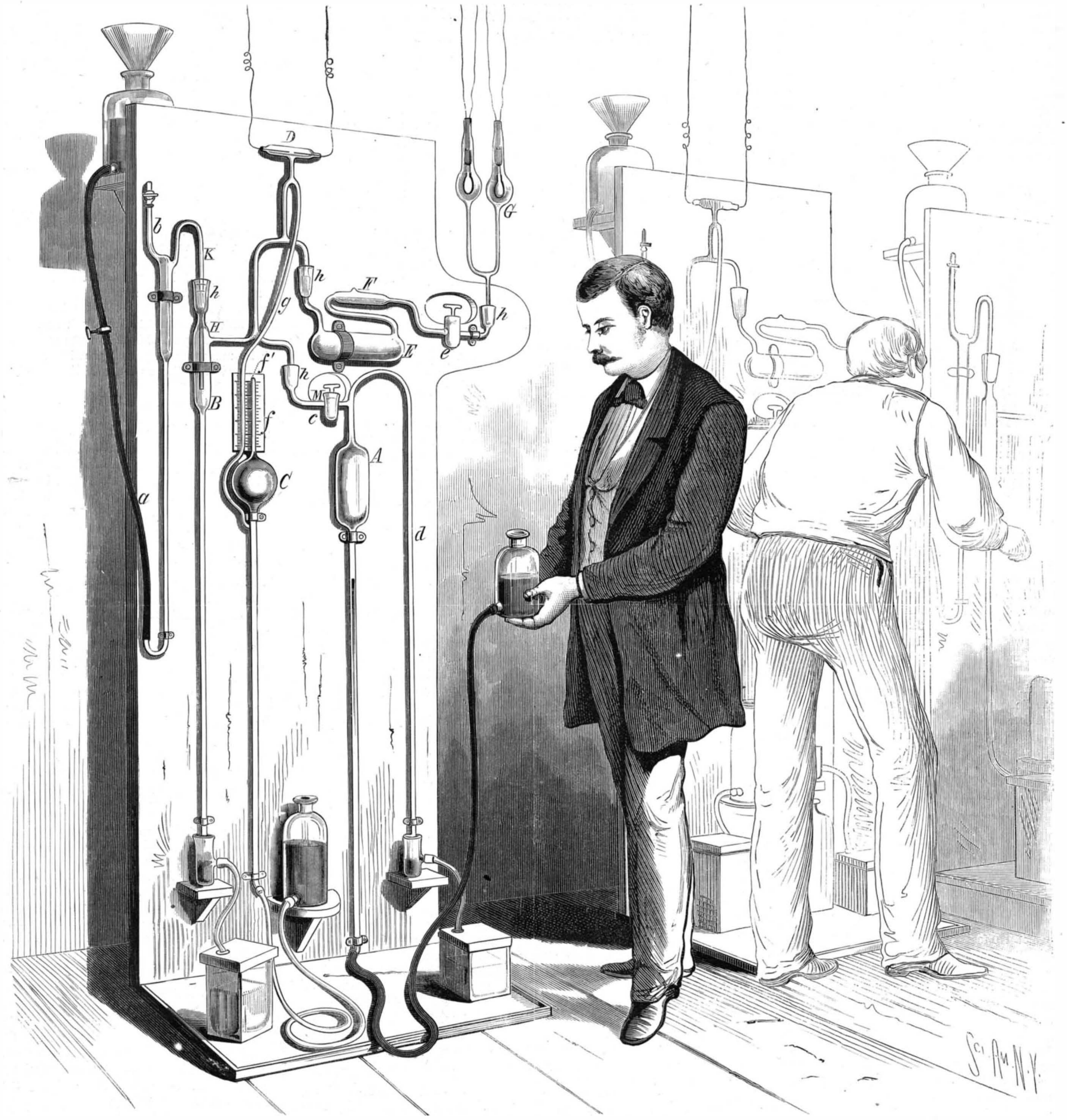
Several sets of this apparatus are employed by Mr. Edison, and he has so far improved their construction and working as to enable the attendant to produce very high vacua in twenty-five minutes.

The Geissler pump, A, the Sprengel pump, B, and the McLeod gauge, C, are all connected with the socket that receives the lamp bulbs, through the bulb, E, which is partly filled with phosphorous anhydride—a powerful absorbent of moisture—and through the bulb, F, which contains gold leaf to absorb traces of mercurial vapor. Each set of apparatus is secured to a vertical board, behind which on a bracket near the top sets a reservoir of mercury, which supplies the Sprengel pump, B, through the flexible tube, *a*, and through a vertical glass tube, having at the top a trap, *b*, for receiving any air that may be carried by the mercury.

The Sprengel pump, E, consists of a glass tube about ⅛ inch in internal diameter and 36 inches in length, dipping at its lower end into mercury contained in the small vessel resting on the bracket, and having an overflow connected by a flexible tube with a mercury receiver. At the upper end of the ⅛-inch tube is formed a bulb, into which the mercury supply tube enters through a sealed joint (described elsewhere) and extends about two-thirds of the way down the bulb. The bulb is provided with a lateral tube by which it is connected with the Geissler tube, D, and with the bulbs, E and F, which communicate with the lamp bulbs, G. The Sprengel pump also connects with the Geissler pump, A, when the stopcock, *c*, is open.

The Geissler pump, A, is simply a glass tube, having a bulb blown in it, and communicating at its lower end with a mercury reservoir through a flexible tube, and connecting at its upper end with the Sprengel pump, B, as before described, and also with a bent discharge tube, *d*, of small caliber, which extends downward something over 36 inches and dips into mercury contained in a small cup provided with an overflow.

The McLeod gauge is no more complicated than either of the pumps. It consists of a bulb, *c*, blown on the end of a tube of small diameter, and having a still smaller tube, *f'*, projecting from its upper surface. This tube is closed at the top, and its capacity bears a certain ratio to that of the bulb. It extends over the face of a scale, *f*. The longer and larger tube of the gauge is connected by a flexible tube with the mercury bottle seen resting on the bracket; and it is also connected by a small tube, *g*, with the system of




A.—Geissler's Pump. B.—Sprengel's Pump. C.—McLeod's Gauge. D.- Geissler Tube. E.—Bulb containing Phosphorous Anhydride. F.—Bulb containing Gold Leaf. G.—Electric Lamp Bulbs. *a.*—Mercury Supply Tube. *b.*—Air Trap. *c. and e.*—Mercury Sealed Stop Cocks. *d.*—Discharge Tube. *f.*—Scale. *f'.*—Gauge Tube. *g.*—Connecting Tube. *h.*—Mercury Sealed Joints.

**VACUUM APPARATUS FOR EXHAUSTING EDISON'S ELECTRIC LAMPS.**

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tubes that connects the two pumps, the Geissler tube, and the lamp bulbs. The connecting tube, *g*, extends over the scale, *f*, parallel to and near the gauge tube, *f'*.

To produce a vacuum in the bulbs, G, the pinch-cock on the rubber pipe, *a*, is opened so as to permit a rapid succession of drops, or a full stream of mercury to flow down the internal tube of the Sprengel pump, B. This stream of mercury, falling through the space between the internal tube and the lower end of the bulb, enters the long tube of the pump, and carries with it a certain quantity of air, which is discharged together with the mercury into the cup at the bottom. As this process is too slow for creating a vacuum from the beginning, while the Sprengel pump is still working, the Geissler pump, A, is brought into use for removing the greater portion of the air. To operate this pump, the stopcock, *c*, is first closed, the reservoir of mercury—connected with the pump by a rubber tube—is raised by the attendant, as represented in the cut, until mercury flows up the long pump tube, and filling the bulb, drives out the air before it through the discharge tube, and finally overflows through the tube, *d*, into the cup at the lower end of the tube. The mercury reservoir is then lowered until the two vertical columns of mercury break in the bend of the discharge tube, and the mercury in the pump is below the stopcock, *c*, the latter is then opened, and the mercury reservoir is lowered until the mercury in the pump will sink no farther. The stopcock, *c*, is then closed and the operation is repeated two or three times. The Sprengel pump, which has been in operation meanwhile, is now permitted to finish the work. As the vacuum becomes more and more perfect the mercury rises in the pump, and when the drops strike the mercury column, a sharp metallic clink is heard, indicating that the atmospheric resistance to the falling metal is little or nothing. As fast as the mercury accumulates in sufficient quantities in the reservoir below, it is poured into the reservoir above.

Electric sparks from an induction coil are continually

Fig. 2.

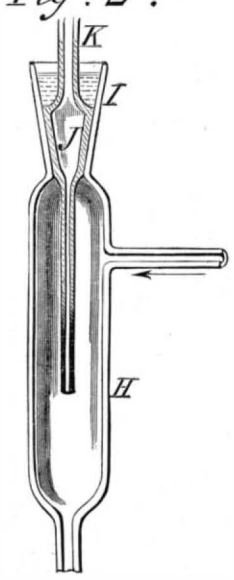


Fig. 3.

passed through the Geissler tube, D, as long as the vacuum is low enough to admit of it. Mr. Edison says that when a 9 inch spark fails to pass the ⅛ inch space between the electrodes in the tube the vacuum is still coarse.

The McLeod gauge is relied on mainly for testing the perfection of the vacuum. This gauge is operated by simply raising the mercury reservoir connected with it until the gauge bulb is sealed off from the other parts of the apparatus, the mercury, as it rises, closing the connecting tube, *g*. The mercury reservoir is then raised still further, until the mercury will go no higher in the gauge tube, *f'*. Should the mercury rise to the end of the gauge tube it would indicate a perfect vacuum, but this is never attained. The quantity of air contained in the tube, *f'*, indicates exactly the proportion of the air in the apparatus to the capacity of the apparatus or air at its normal density. Another method of calculating the value of the vacuum is based upon the difference in the level of mercury in the two tubes in front of the scale, *f*.

Mr. Edison informs us that the vacuum in his lamps is so nearly perfect that only a millionth of the original volume of air remains.

It is obvious that the Sprengel and Geissler pumps must be longer than a barometer, to obtain the full effect of the falling column of mercury. All of the rigid parts of this apparatus are made of glass, and wherever there is a joint or a stop cock, it is sealed with mercury. Figure 2 shows the upper portion of the Sprengel pump in detail, and also gives a good idea of the manner of sealing the joints. The bulb, H, has a conical mouth, I, into which is fitted and ground the enlarged portion, J, of the mercury tube, K. The space in the mouth, I, above the enlarged part of the tube, K, is filled with mercury.

Figure 3 represents a mercury-sealed stop cock, L being the stop cock, entirely surrounded by mercury contained in the cup, M.

The lamp bulbs, G, are connected with the apparatus by a joint similar to that represented in figure 2. From time to time, while the air is being exhausted from the lamps, they are tested by connection with wires from the electrical generator. When the vacuum is practically complete, the tubes connecting the lamps with the vacuum apparatus are heated by a spirit lamp, sealed and separated from each other and from the apparatus.

## LABORATORY APPARATUS.

The laboratory apparatus designed and patented by Thomas Fletcher, F.C.S., of Warrington, England, has been long and favorably known in Europe, and has recently been largely introduced in this country by the Buffalo Dental Manufacturing Company, of 307 and 309 Main street, Buffalo, N. Y., who have made arrangements with Mr. Fletcher to manufacture all of his specialties.

The apparatus, consisting of hot and cold blast blowpipes, blowing apparatus, gas furnaces with and without blast, ingot moulds, and a great variety of other articles, is designed for colleges, academies. schools, chemists, assayists, manufacturing jewelers, dentists, artisans, and experimenters.

We have chosen a few of the leading articles for illustration and description.

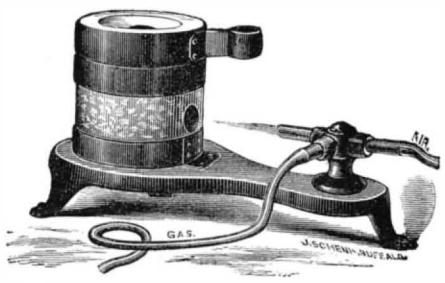


**Fig. 1.—FLETCHER'S NEW CRUCIBLE FURNACE.**

Fig. 1 shows a new crucible furnace, consisting of a simple pot—for holding the crucible—with a lid, and a blowpipe, all mounted on a suitable cast iron base. As compared with the ordinary gas furnace it appears almost a toy, owing to its great simplicity.

The casing, which consists of a new material discovered by Mr. Fletcher, holds the heat so perfectly that the most refractory substances can be fused with ease, using a common foot blower. Half a pound of cast iron requires from seven to twelve minutes for perfect fusion, the time depending on the gas supply and pressure of air from the blower.

The power which can be obtained is far beyond what is required for most purposes, and is limited only by the fusibility of the crucible and casing. A suitable crucible will hold about ten ounces of gold.

An ordinary gas supply pipe, five sixteenths or three eighths will work it efficiently. It is said to require a smaller supply of gas than any other furnace known. About ten cubic feet per hour is sufficient for most purposes.

Any common blowpipe bellows will work the furnace satisfactorily except for very high temperatures (fusion of steel, etc.), for which a heavy pressure of air is necessary.

The furnace shown in Fig. 2 will take crucibles up to four by three and a half inches, and with half inch gas pipe, giving a supply of about thirty feet per hour, will melt three or four pounds of brass in about twenty-five minutes, and the same quantity of cast iron in about fifty minutes from the time the gas is first lighted, without the slightest trouble or attention. It will melt a crucible full of silver or gold in twenty-five minutes. The crucible will hold and melt about six pounds when quite full. It is made in a very substantial manner, and is recommended

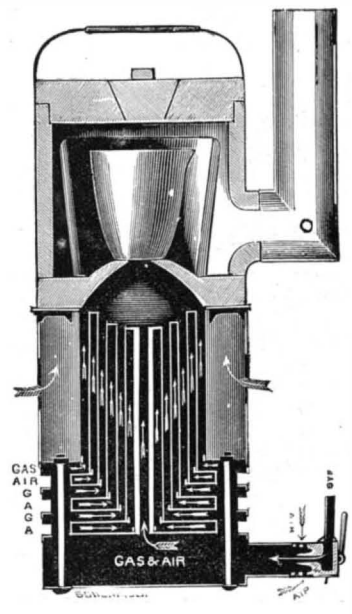


**Fig. 2.—LARGE CRUCIBLE FURNACE.**

as a first-rate furnace for manufacturing jewelers, reducing photo. waste, etc. In using this pattern of furnace, the narrow end of the plumbago cylinder which surrounds the crucible is always put downward. The use of this cylinder is to keep the flame in contact with the crucible up to the top. The flame is then deflected by striking against the lid, and, turning downward, leaves the furnace by the chimney, at the lower side.

The lid never gets very hot, and can be lifted away by the handle across the top; it is now made of the patent non-conducting material, in one piece, with an opening in the center for convenience in examining work. This pattern of furnace requires no blast.

The furnace shown in Fig. 3 takes crucibles up to two and a half by two and a quarter inches outside. This pattern is more especially designed for gold, silver, copper, etc., and, as sent out, with four foot chimney and single lid, E, is amply powerful. If required for temperature up to the fusing point of cast iron, it requires a chimney six feet high.

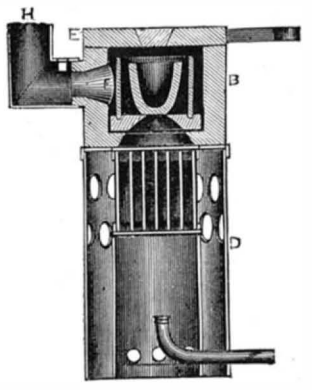


FIG. 3.—Small Crucible Furnace.

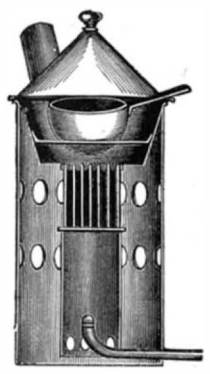

FIG. 4.—Ladle Furnace.

The ladle furnace represented in Fig. 4 takes ladles up to six and a half inches diameter, and will melt six or eight pounds of zinc in about fifteen minutes, or the same quantity lead, tin, etc., in half the time. It is a convenient and powerful arrangement for dentists, heating soldering irons, etc.

Fig. 5 shows a simple, compact, and powerful blower. The step for the foot is very low, and enables the blower to be used with ease whether the operator is standing or seated. The pressure is steady and equal. If the rubber disk is distended until forced against the net, the pressure can be increased to almost any extent desired. It will give, if required, a heavy and continuous blast through a pipe of one quarter inch clear bore.

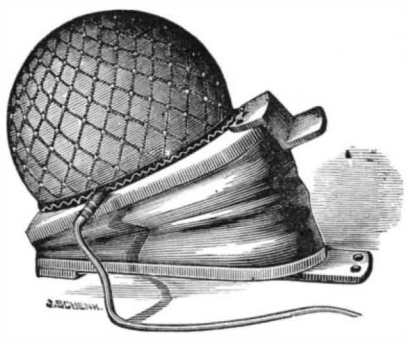

**Fig. 5.—FOOT BLOWER.**

These compact and well designed pieces of apparatus supply a want long felt by our artisans and experimenters, and will undoubtedly meet with the success they merit.

The Buffalo Dental Manufacturing Company supply an illustrated catalogue giving descriptions of many other pieces of apparatus of this character.

## Preserve Your Papers.

Thousands of subscribers understand this, save their numbers, and have them bound at the end of the year; others thoughtlessly lose or destroy the first few numbers they receive after subscribing, and subsequently regret they had not preserved them. A year's numbers make a volume of over 800 pages, and to every one it will be found useful for reference.

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## Starch Photo. Process.

In consequence of the remarkable results obtained by gelatine and silver bromide, experimentalists have been induced to try starch and gum emulsions, and the latest contribution to this branch of photography is a formula for a starch emulsion by Senors Pauli and Ferran, of Barcelona. Take four grammes of potato starch and mix to a creamy consistency with twenty grammes of water; then add slowly eighty c.c. of boiling water, and, while the fluid is still hot, 1·12 grammes of bromide of potassium and 1·62 grammes of silver nitrate dissolved in twenty c.c. of water. It is recommended to add a little gelatine to the starch, in order to lessen the solubility.

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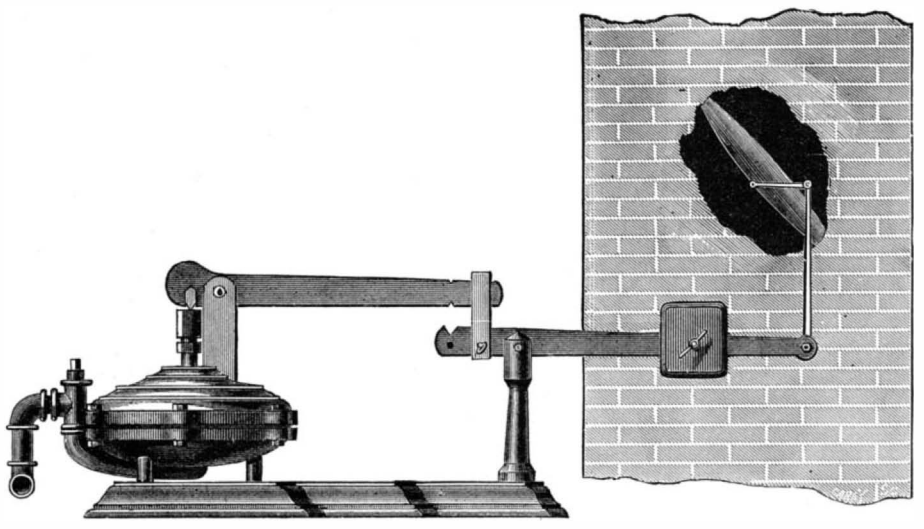
### NEW DAMPER REGULATOR.

We give herewith an engraving of a recently patented automatic damper regulator, embracing several novel and valuable features. The mechanism of this regulator insures a large increase of leverage, movement, and sensitiveness, by the use of a compound lever, having adjustable fulcra, by means of which the same machine is adapted to the use of either high or low pressure; each regulator is provided with a siphon attachment, to prevent the contact of steam with the diaphragm. The diaphragm is perfectly supported, and is arranged so as to roll instead of stretching or wearing it, thus making it more durable than other forms of diaphragm.

This regulator will be readily understood by reference to the engraving, and will be appreciated by practical engineers. The great saving in fuel, the steady power, the regularity of speed, and the guaranty of safety from explosion by excessive steam pressure, are features which must recommend it to all steam users. It is claimed by the manufacturers that it will control the pressure of steam within one pound, and *fully* open or close the damper on a variation of two pounds.

The American Steam Appliance Company, of 13 and 15 Park Row, New York, and 28 School street, Boston, Mass., are sole manufacturers of the regulator.



PEERLESS DAMPER REGULATOR.

### The Lick Observatory.

The recent decision of the courts with regard to the Lick estate in California gives the trustees of the estate $700,000 for carrying out the observatory project, which will be pushed forward as rapidly as possible. The question as to the kind of telescope to be adopted has not yet been settled, and the respective merits of the reflecting and the refracting telescopes are being investigated. As the trust deed directed that the instrument should be the most powerful in the world, a refractor of over thirty inches in diameter will have to be obtained, as two of twenty and thirty inches have recently been ordered, respectively for the Vienna and Pultkowa observatories. It will take two years from the time the order is given before the disks will be ready for the opticians, and it is calculated by the trustees that three years will elapse before they can turn their attention to the third bequest, the School of Mechanic Arts.

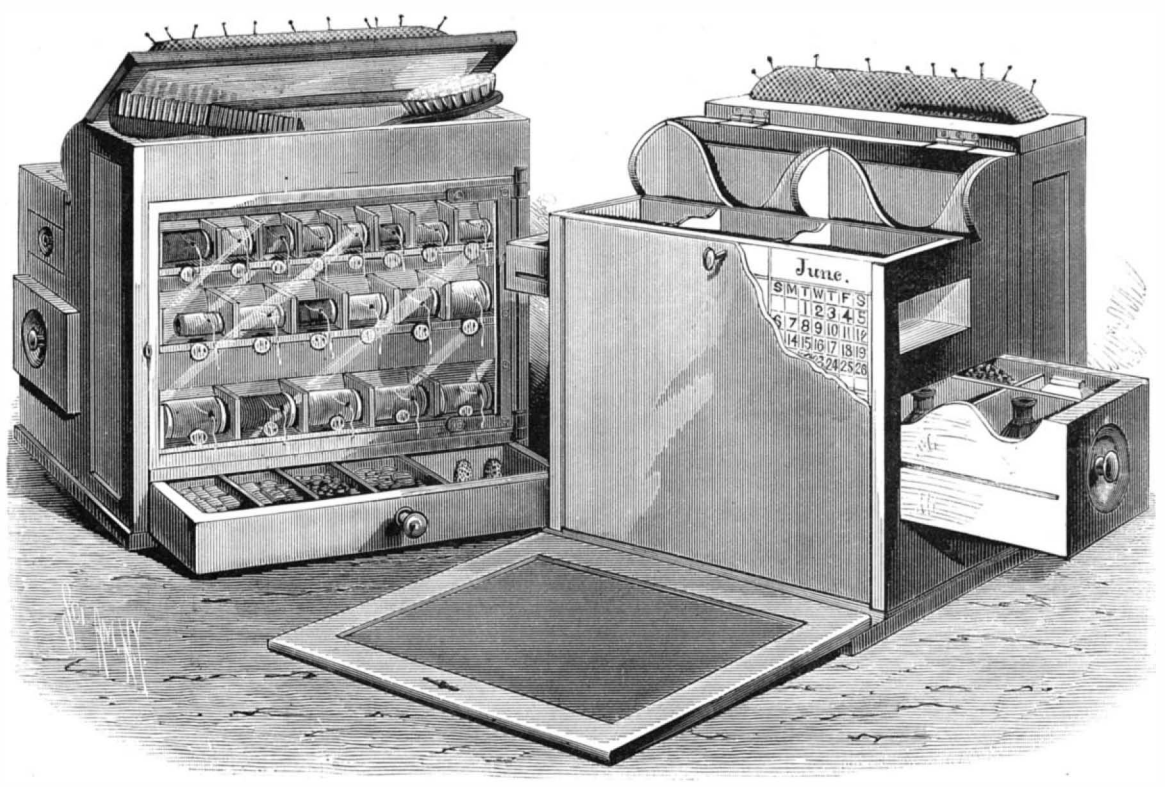
### NOVEL TOILET CABINET.

The accompanying engraving shows opposite sides of a compact and convenient cabinet recently patented by Mr. F. C. Zanetti, of Bryan, Texas. It is designed for containing sewing, writing, and shaving materials, and various other articles of domestic use in frequent demand. In this receptacle these articles can be arranged in an orderly and convenient manner, so that any one or more of them can be obtained, when needed, instantaneously and without trouble.

The invention consists of an outer case, divided inside by horizontal and vertical partitions into three separate compartments. The first of these compartments, at the front of the cabinet, is provided with a mirror at the back, racks for spools, razor cases, and razor strop, and is closed by a glass door, on the inside of which are fixed racks for spools, and through the glass, opposite each spool, are perforations through which the ends of the threads are passed, so that the thread can be taken from the spools without opening the door. A subdivision of this compartment above serves as a receptacle for brushes and combs, and the cover of the receptacle has a mirror on its under side and a pincushion on the upper side. The second compartment is subdivided for the reception of drawers adapted to be drawn halfway out from each end, and envelope, card, and paper cases and pen racks. The third compartment is provided with a drawer opening from the front of the cabinet, said drawer being subdivided into cells for the reception of various articles used in sewing and mending. The back of the cabinet is provided with a hinged and folding slate and writing tablet and a place for a large calendar.

This cabinet is designed to contain a class of articles that too often are not provided with a place, and are liable to be found almost anywhere in the house.

Further information may be obtained from the inventor.




ZANETTI'S TOILET CABINET.

### The Unitary Theory of Electricity.

Herr Edlund has drawn attention to an electrical experiment that has not hitherto been thoroughly explained. Let an open metal tube or cylinder, capable of rotation about its axis, be placed over a magnet of double its own length, so that its lower end is opposite the middle of the magnet, while its upper end is opposite the magnet pole. Then let a current of electricity of sufficient strength be passed from one end of the tube to the other. The tube is found to rotate with a velocity which is independent of the resistance of the metal of which it is composed and of its thickness. Longitudinal slits cut in the tube do not affect its rotation. There is, therefore, here a complete conversion of electromotive force into ponderomotive force. W. Weber inferred that the resistance of the movable conductor to the passage of the current is the medium of this transfer of the energy, and argued that the first tendency is to rotate the current in the conductor, but that as this could not be done without moving electricity through the substance of the conductor, and therefore against its resistance, the principle of least heat requires that the energy should be transferred in an indefinitely short time to the conductor itself, which therefore rotates. Herr Edlund, however, sees in the experiment a confirmation of his "unitary" theory of electricity.

### Preparation of Cotton for Pyroxyline.

M. Aimé Girard is the author of a new means of preparing cotton to fit it for making pyroxyline. The cotton is thoroughly impregnated with a solution of carbonate of soda, and, when well washed, it is then thoroughly dried. The cotton thus treated is then plunged into a bath composed of water, 100 parts, nitric acid, 3 parts.

A very pulverulent cotton is thus obtained, which M. Girard names "hydro-cellulose." It appears that this product is far superior to the ordinary cotton for obtaining excellent pyroxyline for photographic purposes. The photographic pyroxyline is obtained by immersing the hydrocellulose in a solution composed of sulphuric acid (66°), 1800 grammes, nitric acid (40°), 680 grammes.

After twelve minutes' immersion the pyroxyline is thrown into a basin of water and then well washed under a tap. It is then allowed to dry spontaneously in a dry room.

### STEREOSCOPIC LANTERN PICTURES.

As you have again opened this interesting subject, I shall be glad if you will permit me to place on record a few thoughts of my own respecting it.

The production of stereoscopic effect by the lantern upon a large screen has at intervals, for a considerable period of time, been the object of experiment with me, says Mr. John Harmer, in the *British Journal of Photography*, the outcome of which, up to the present, is a method of obtaining it having one of the disadvantages of, though it appertains to, the other methods mentioned in your leading article, namely, the necessity for each spectator to be provided with a piece of apparatus to make the effect evident.

The arrangement requires a couple of lanterns—one to project the left eye half of a stereoscopic transparency, the other the right eye one, each of which when projected must occupy as nearly as possible the same part of the screen, and being, if viewed together, in hopeless confusion. In front of the two lanterns must be fixed a revolving disk, pierced with three apertures in such a position with respect to the lanterns that the light shall not be allowed to pass from one of these instruments till the other is exactly shielded. With this disk in motion the right and left halves will be thrown alternately upon the screen, producing, if the motion be sufficiently rapid, just the effect of two open lanterns, the only difference being that the extremely small intervals of darkness would slightly reduce the illumination without affecting the continuity of the mental impression in the least.

The piece of apparatus necessary for resolving this confusion into stereoscopic effect is composed of two eyepieces, having a revolving disk similar to the one just described in every respect except size, this latter bearing the same proportion to the larger disk as the eye does to the lantern lens. The revolutions of these must synchronize exactly, so that when the left eye picture is allowed to pass to the screen the left eye must be uncovered to view it, the same being required for the right eye and its picture, and the rate of motion must be such that the alternate projection of the pictures must take place not less than ten times per second. Each eye will then see its own proper picture in the same direction, and will deal with the dissimilar impressions as with those obtained direct from nature.

The synchronous movement of the disks could be obtained, if the apparatus were fixed by band and pulley, or, to secure the advantage of portability, by a small electromagnetic engine and phonic wheel, by which a number of disks could be driven. If the above were constructed for exhibition purposes the disks could be arranged to produce stereoscopic, pseudoscopic, and superscopic effects—the first by an eyepiece adjusted as above, the second by providing for either to be uncovered at the instant the picture for its fellow was visible, and the last by a disk revolving at half the rate of the lantern one, thus cutting off the light of one lantern entirely.

In your *résumé* you omitted to mention a very excellent method discovered by the late M. Claudet some years ago, which he described and exhibited before the Royal Society at the time. He obtained the key note in the following manner: While experimenting with a "focimeter" he noticed that the image of the instrument upon the focusing screen of the camera appeared to possess its three dimensions—length, breadth, and thickness. This at once led him to investigate the cause, which he found to proceed from the fact that each eye actually sees a different view of the image produced by a lens upon a translucent screen, the natural object appearing to be viewed by the eye through screen and lens, the relations of its parts being affected by any change, just as would be the case if no apparatus were interposed, size excepted. This principle he embodied in an arrangement for exhibiting stereoscopic effect on a large scale in this wise: A large sheet of ground glass was erected perpendicularly, behind which, at a suitable distance, were placed a couple of lanterns, each one inclined inward sufficiently to throw its half of the stereoscopic picture upon the screen, with the axes of the lenses crossing there, to press onward into the eyes of the spectator some feet in front. It is manifest that this cross-

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ing will necessitate the right-eye picture being put into the lantern on the left hand, the left-eye one into that on the right, and the ground glass to be viewed from a fixed position in front, thus preventing the effect from being observed by many persons together.

## AMERICAN INDUSTRIES.—No. 28.

### THE MANUFACTURE OF WOOD-WORKING MACHINERY.

Among the various mechanical industries of the world there is none—with perhaps the exception of iron—which is more widely spread or employs more capital and labor than the working of wood in the manifold uses to which it is applied. In the present advanced state of manufactures machinery is employed for nearly every process to which wood is subjected. From the wooden toothpick to the railway car or the palace of royalty, machinery is used for producing the required form. The manufacture of machinery for working wood has become, therefore, one of our most important industries, for only by securing the greatest perfection in the machinery employed, can the best results be obtained.

We have selected as the representative of this industry the house of C. B. Rogers & Co., at Norwich, Conn., the oldest as well as one of the largest engaged in this business. The house originated at Keene, N. H., in 1832, when Mr. J. A. Fay commenced the manufacture of mortising and tenoning machines for sash and door work. Previous to that time, with the exception of the Woodworth and Daniels planers, saws, and a few special tools, very little wood-working machinery was used. The new machines made by Mr. Fay met a ready sale and increased demand, and in 1848 Mr. C. B. Rogers engaged with Mr. Fay in the business, opening a factory at Norwich, Conn., for the purpose, and bringing out the sash sticking machine, which met with such an unprecedented demand that for over three years one machine per day was the average sale. A few years later a shop was started at Worcester, Mass., which was devoted to Woodworth and Daniels planers.

In 1861 the death of Mr. Fay, together with the need of condensation of the business at some central shipping point, made it advisable to remove the entire business to Norwich. The firm was made into a joint stock corporation, a large works erected to accommodate the whole business, and the name, which up to this time had been J. A. Fay & Co., was changed, and the present title, C. B. Rogers & Co., adopted. The history of the establishment from the start has been one of progress, and the inventive talent of the managers has been kept constantly employed to keep pace with the demand for improvement. Many of the most indispensable machines in use originated with this house—notably the power mortiser, tenoning machine, sash sticker, and four side moulding machine.

The works, of which the central cut of our first page illustration is a fine representation, are located in the city of Norwich, Conn., on the banks of the river Thames. The location is most excellent as regards freighting facilities—an important item with this class of goods—the city being midway between Boston and New York, with a daily line of steamers to the latter, and two railroads centering there, by which freights may be forwarded expeditiously to all points, and are by special arrangement to all Western points at the regular New York freight tariff. The works, including the foundry, cover nearly three acres of ground. The manufactory surrounds three sides of a quadrangle, and consists of the main building, 125x45 feet, four stories, with blacksmith shop, 30x25 feet, attached; a wing, 65x40 feet, four stories; and a second wing, 50x20 feet, three stories. The fourth side is occupied by a storehouse, 100x30 feet, three stories, for lumber and coal. The factory has about 40,000 feet of floor space.

Entering the works at the north end, ground floor, we come first to the motive power, steam, applied to an 80 horse power high pressure double engine, built by this company, running 125 revolutions, and so delicately adjusted in its valve motion that the stoppage of half the tools in the building can scarcely be detected in the speed. Passing the engine, we enter the "planer room," so-called from its being devoted exclusively to the manufacture of planing and matching machines. Our artist has sketched this room entire, with the various planers in process of construction. Of this class of tools this house make twenty different sizes and styles, from the diminutive "Pony," so-called, to the planer and matcher weighing from four and one half to five tons. The greatest care is used in the construction of these machines, and the latest improvements and processes are applied. A recent one is the use of cast steel for all cylinder heads, as well as for the smaller gearing where the wear is greatest. The severe tests to which these machines are put have always proved successful and eminently satisfactory to the user. In the center of the room, but upon the outside, is an elevator running to the fourth story, and sufficiently powerful to raise the heavy planers to the street level for shipment.

Leaving the planer room, we pass through a store room filled with bar iron, of all shapes and sizes, and enter the blacksmith shop, which has six forges, two trip hammers, power shears, and all facilities for the various forgings. From here we ascend to the second floor, machinist room. This floor is engaged on moulding machines, of which seven sizes are made; sash machines; mortisers, twelve sizes; tenoners, seven sizes; band saws, three sizes; scroll saws, railway cutting off and splitting saw frames, resawing machines, and various other tools.

Passing the casting room, where tons of castings are in process of cleaning, we ascend the main staircase to the third floor or "wood room." This floor is engaged upon woodwork; framing machines, making foundry flasks, pattern work, of which a large amount is required in the production of new machines and alteration of the old. Although iron frames are the rule for most machinery, some of the wood frames are still retained as being lighter and cheaper—as the sash machine, tenoner, saw tables, etc. The frames retain their position equally with iron, but to insure this a large stock of hard wood is kept in store and seasoned for years before using. On this floor is the paint room, where the finishing touches are applied and the gray iron rendered more agreeable to the eye. At the south end of the room—the foreground in the sketch—is one of the most important departments in the building, where every machine before being shipped is thoroughly tested on the work it is designed to perform, and any error or oversight in the construction corrected. This was for many years a system followed only by this house, and its value has been amply proven by the universal success of the machines sent out.

Many purchasers have but a limited knowledge of machinery, and it is a great assistance to them to receive their machines all set and with tools prepared ready to set at work. The machine shown as being tested is a vertical tenoning machine made for tenoning car sills and doing the heaviest work with great ease and rapidity. The company have recently completed a machine of this class for working oak timber 16 inches square, cutting a double tenon 8 inches deep at one cut. A companion machine to this is the rotary car mortising machine, which works mortises 12 inches deep, 15 wide, and any length required, the timber being moved by power, and the whole operation almost automatic.

Upon the fourth floor is the "machinist room." This is similar to the second, but engaged on a lighter class of tools, with one exception—the inside head moulder, which is one of the finest tools in use. It weighs 3,500 pounds, and works moulding up to 12 inches wide, and by special adjustments is capable of producing 50,000 feet of narrow mouldings per day, a feat said to be unequaled by any other machine. Among the other tools are: iron frame tenoning machines, whose advantages consist in great facility of adjustment and ease of operation; upright shaping machines, five sizes; boring machines, one ingenious two-bit machine for cabinet work, cabinet jointers for piano work, Reidy's patent ironing and mangling machine, a specialty recently introduced into this country by an English patentee, its peculiarity being the method of heating the roll by a combination of gas and air. Last, but not least, in one corner, occupying but little space, is the manufacture of Boardman's barbed blind staple, which was invented by an employé of the house, and has been made by them for over twenty years. Here several machines are running constantly, for some time past night and day, to produce these little articles, 2,200 of which weigh but a pound, and of which orders have been received within three months for upward of forty tons. It would seem the work of a lifetime to produce such an amount, but the machines are tireless, and, like "Oliver Twist calling for more"—wire—they consume it in their insatiate maws, and the finished staples drop from them like the rain drops.

The three upper floors of the main wing are filled with finished tools ready to be shipped out on order, and the long lines of machines in dozens or half dozens of a kind make a fine display. On the third floor of this wing, a light, pleasant room, with a fine view of the river, is used for draughting the many new designs and improvements required in the business. Something in this line is in process constantly. One of the most recent is the large hub mortising machine, shown in the right hand cut of our illustration. This was produced on a requirement for a machine to mortise a hub 16x18 inches, a task as yet unaccomplished. The machine shown does the work successfully, mortising 8 inches deep in solid hard wood, and although very heavy and powerful—weighing 3,500 pounds—with as much ease to the operator as one of the lighter door mortisers.

This house have always given special attention to perfecting machines for specially difficult classes of work. Complete sets of machinery for making lead pencil woods and finishing the pencils were perfected by this house and furnished to the Messrs. Faber and others. Machines for making meat skewers, turning them out by the million, and many other specialties have been produced, it being only necessary to state the work to be done and something will be invented to meet the emergency. This company work their iron from the pig, the castings being produced in their foundry, of which an interior view is given. It has about 15,000 feet of floor space, two cupolas—one of seven tons capacity, large core ovens, cranes, and every facility for doing a large quantity of work. The present production is from three to four tons on alternate days. The quality of iron is an important item in this class of tools, and the company are able, by making their own castings, to insure the best. Attached to the foundry is the pattern house, 30x15 feet, two stories, and packed to overflowing with the patterns used.

The offices of the house are in the second wing of the works, fronting the street. Here are the accounting department, the correspondence which is extensively carried on with all parts of the world, and in addition to these is a constant production of catalogues, cuts, and circulars descriptive of the various machines. A catalogue is issued frequently of 175 pages, giving full information relative to the 125 different machines made by the house, among which are tools embracing in their ranges of work house building, sash and door, furniture, cabinet and musical instruments, wheels and wagons, railway cars and coaches, to which class special attention is given, planing mills, lumber producers, mouldings and picture frames, brooms, curtain rolls, and in fact for nearly every purpose to which wood is applied. The house has a wareroom at 109 Liberty street, New York, and their shipments extend to Great Britain, France, Germany, Sweden, Austria, Russia, Australia, New Zealand, South America, and every corner of North America, and in nearly every country named the house has a wareroom with machinery in stock.

The machines have been exhibited at every exhibition of note from the Crystal Palace down to the present time, and over 100 medals in gold, silver, and bronze attest the competitive merit of the exhibits.

The present officers of the company are: Lyman Gould, President; R. M. Ladd, Treasurer; and B. H. Rogers, Secretary and Superintendent.

## Correspondence.

### Electrical Generators.

*To the Editor of the Scientific American:*

It would seem that the authors of books and chapters on electricity are largely culpable for the numerous discussions which have appeared of late in the SCIENTIFIC AMERICAN on electrical generators. The problem to find the maximum current with a given lot of battery cells and external resistance is well known; also the answer to it, viz., internal resistance equal external resistance. But the other problem, viz., to find, with given external resistance, the number and arrangement of cells, for procuring a given current with a minimum consumption of zinc, seems to be far less common in books, and perhaps generally, though the result may often be of far greater importance.

To illustrate, suppose that in some electro-plating establishment a plating bath is so run as to offer about constant resistance to current; and suppose a certain standard constant current is preferred. If these conditions can be realized by one arrangement requiring $25 greater outlay in first cost for increasing the number of cells, whereby a saving of $50 a year for zinc is realized; a party, expecting to run for years, would be quite likely to adopt the greater first cost.

What is true in consumption of zinc in batteries will be true, in some measure at least, in dynamo-electric machines, because the zinc consumed in one case represents energy, and so do the foot pounds consumed in the other. Hence, for simplicity, batteries are here considered instead of machines.

That for a given external resistance a given current strength may be maintained by different arrangements of cells in rows, the total number of cells varying as required, is evident from considerations of Ohm's law. For instance, if 100 cells in 5 rows satisfies a certain current and resistance, the same effect may be secured with 10 rows of batteries, though 40 or 60 cells may be necessary. It may happen, however, that a large percentage of zinc will be saved with the 60 cells and 10 rows.

The energy of a current is stated, on good authority, to be proportional to the zinc consumed in a well conditioned battery; also, it is proportional to the electro-motive force multiplied by the current strength. These facts applied so as to bring about the relation between the zinc consumed in different cases will show that *for the same external resistance the weight of zinc consumed in a battery arranged for maximum current; divided by the weight of zinc consumed in a battery by like cells in greater number for an equal current, is simply equal to the number of cells in one row of the first battery, divided by the number of cells in one row of the second battery.*

Also for the relation of numbers of cells, it will be found that the ratio of the number of cells in one row, 1st battery and 2d, added to the ratio of number of rows, 1st battery and 2d, is equal to 2; also, the maximum value of this 1st ratio can never be greater than 2.

An example will serve to fix the ideas: Let the cells of battery considered be all alike, with equal electro-motive forces, and the internal resistance of each equal 1 ohm; let the external resistance equal 4 ohms. If the number of cells be 144, arranged in 24 rows of 6 each, we have the maximum current for the cells of resistance named. Again, if 192 like cells be arranged in 12 rows of 16 each, we will have the same current strength, though the total internal resistance of the 2d will be only a third of the 1st.

According to the rule above, the consumption of zinc in the 1st battery will be 50 per cent greater than in the 2d.

Hence it appears that the best arrangement of a battery of several cells for maximum of current is one thing, while the best number and arrangement for securing a given current with a minimum of zinc is quite another. The quantity of zinc diminishes with internal resistance.

From the fact that zinc consumption in a battery stands for about the same thing as foot pound consumption in the dynamo-electric machine, it would seem that for the minimum of power the internal resistance of the machine should be reduced to as small a fraction of the whole as possible, the size of the machine and conditions of working being, of course, consistent with the given current required.

S. W. ROBINSON.
Dep. Phys. and Mech. Eng., Ohio State University.

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## HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

### HEATING SURFACES.

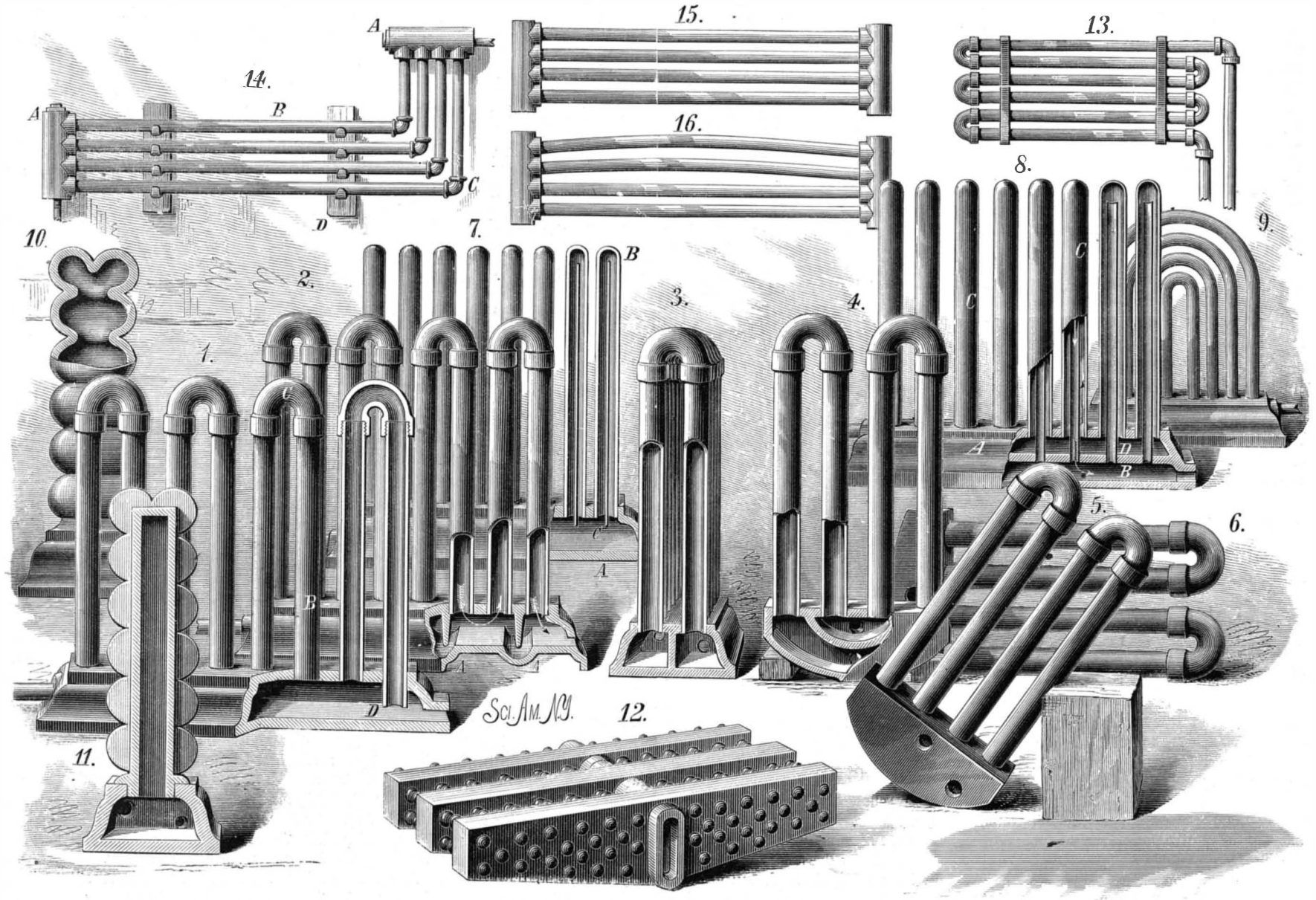
All radiators, box coils, flat coils, plate or pipe surfaces, arranged to warm the air of buildings, are heating surfaces.

The vertical tube radiator is now the accepted type of a first-class heater, and most all manufacturers have their own peculiar style with varying results as to efficiency, and the steam fitter or purchaser should use great caution in the selection of radiators.

The common return-bend-radiator, Fig. 1, is the most widely manufactured; it is not patented, and is second to no other vertical tube heater.

The construction is simple, a base of cast iron, A, being simply a box without diaphragms, with the upper side full of holes, about 2¼ inches from center to center, tapped right-handed; a pipe, B, for every hole, 2 feet 6 inches or 3 feet long, threaded right and left handed, and half as many return bends, C, as there are pipes tapped left-handed.

The manner of putting these heaters together is to catch the right-handed thread of two pipes one turn in the base, then apply the bend to the upper and left threads of the same two pipes, and screw them up simultaneously with a pair of tongs on each pipe, and a second person holding the bend with a wrench made for the purpose.




Steam fitters who buy bases and make only a few radiators to keep the boys at work when in the shop, should count each set of threads in, but they who make for the trade gauge their threads and pipes so as to always enter the base first. If the pair of pipes in any one bend are not plumb, screw the pipe at the side from which they lean a little tighter; this this will shorten that side and draw the bend over.

I will here explain the action of steam entering a radiator, as nearly all the patents on the so-called positive circulating radiators are to facilitate the expulsion of the air and the admission of steam.

The general impression among steam fitters is that when steam enters a radiator the air is backed up and confined in the top of the pipe, and so it will be when the pipe is single and closed at the top, without any of the usual means to get it down; *this is so*, although steam is not quite one-half the weight of air, and it may seem an anomaly to the scientific engineer.

When two pipes are connected at the top with a bend, or when there is an inside circulating pipe or diaphragm of sheet iron slipped into it, the air immediately gives way and falls in the pipes nearest the inlet first; but should there be no air valve on the radiator, the air will be crowded at first to the further end of the radiator, and should the system be a gravity circulation, without an outlet to the atmosphere, it will remain in the radiator, impairing its efficiency and often deceiving the novice, as it in time heats by contact with the steam; but when there is a thumb cock or air valve on the radiator, usually on the furthermost pipe from the inlet, the result is quite different. In the common return-bend radiator and others of good construction the action is direct, and the pipes heat consecutively, excepting, perhaps, the pipe the air valve is on and a few near it which sometimes heat ahead of their order, on account of the draught of the air valve.

Thus when the steam enters a well constructed radiator the air falls to the base and is driven out at the air valve, the pipe of which may be run down inside the base (as seen at D, Fig. 1), which will bring it into the lower stratum, drawing it off to the last.

This is the most simple test for a good heater, and any make of radiator that nearly always has a few cold pipes, sometimes in one part of the heater and sometimes in another, should be avoided.

Fig. 2 shows a device (patented) for making a return bend radiator positive. The pockets, A A, filling with condensed water, makes a seal which at times prevents the flow of steam along the base and forces it in a continuous stream through the pipes (see arrows in cut).

Figs. 3 and 4 show cross section of modifications of positive return bend radiators. Fig. 3 can be used as a vertical radiator only, but Fig. 4 can be used in any position from perpendicular to horizontal, as seen at Figs. 5 and 6, and is peculiarly adapted to indirect heating.

Single tube radiators welded, or closed at the top with a cap, with an inside circulating device, are also much used; some of them compare favorably with the return bend radiator, but are slower in heating.

Fig. 7 shows the first of this class put on the market. A is the cast iron base, B the welded tube, and C the septum of wrought iron slipped inside the tube and projecting an inch into the base. This heater depends on the gravity of the air for a circulation.

Fig. 8 shows another heater of this class which is positive in its action. A, cast iron base; B, diaphragm cast in base; C, welded tube; D, inside tube, open top and bottom and screwed into the diaphragm. The action of the steam can be seen by the arrows.

Fig. 9 shows a fire bent tube radiator very positive in its action.

Cast iron radiators are of two kinds, *plane* and *extended* surfaces.

Plane surfaces, as the trade understands them, may be either flat round, or corrugated, provided the coring or inside surface of the iron corresponds and follows the indentations of the outside, as in Fig. 10, and all wrought iron heaters. Extended surface is understood when the outside surface of the heater is finned, corrugated, or serrated, with the inside straight, as in Fig. 11.

For direct radiation where the heater is placed in the room there is little or nothing gained by having the surface of the heater extended, and a steam fitter in calculating the extent of his heating surfaces should not take into consideration the whole outside surface of such a heater; he should simply treat it as if the projections were cut off, leaving a flat or plane surface.

For indirect heating (the coil to be under the floor or in a flue) the result is a little different when in comparison with shallow plane surface coils, where the air cannot stay long enough in contact with them to get thoroughly warmed, but presses into the room without hinderance. In this case the extended surface gives a better result, not because a square foot of the surface can transmit as much heat in the same time, but because it hinders the direct passage of the air, holding it longer in contact and preventing stratification.

The cast iron vertical tube radiator is a quick heater, the large size of the tubes causing large and few chambers, which expedites the expulsion of the air.

Fig. 12 shows stack of cast iron extended surface radiators for indirect heating.

Sheet iron radiators are used in very low-pressure heating, the commonest form of which is the flat Russia iron heater, seamed at the edges and studded or stayed in the middle, with a space of about ⅜ of an inch between the sides. They are used in a one pipe job.

### COILS.

Coils are always made of wrought iron steam pipe and fittings, and though not considered an ornament are first-class and cheap heaters.

Fig. 13 shows a *flat coil*, which is a continuous pipe connected with return bends at the ends and strapped with flat iron, which is a very positive heater.

Fig. 14 shows a miter or wall coil. It is composed of headers or manifolds, A A; steam pipes, B; elbows, C; and hook plates, D.

There are many modifications of this coil, but one indispensable point in the making of it is, it must *turn a corner* of the room or miter up on the wall. The pieces from the elbows to the upper header are called *spring pieces*, they are screwed in right and left, and are the last of the coil to be put together.

If a coil is put together straight between two headers, as seen at Fig. 15, it will be like Fig. 16 when heated, and cannot be kept tight for a single day, the expansion of the first pipe to heat being a powerful purchase to force the

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headers asunder, and when it cannot do so it will spring them sidewise.

TO ESTIMATE THE AMOUNT OF HEATING SURFACE NECESSARY TO MAINTAIN THE HEAT OF THE AIR OF INCLOSED SPACE IN BUILDINGS TO THE DESIRED TEMPERATURE.

The ordinary rule-of-thumb way of the average pipe fitter is to multiply the length by the breadth of a room and the result by the height, then cut off two figures from the right hand side, and call the remainder square feet of heating surface, with an addition of from 15 to 30 per cent for exposed or corner rooms.

In the computing of heating surfaces there is much more to be considered, and it is evident the amount of surface necessary for a good and well constructed building will not be enough for a cheap and poorly put up one.

The cubical contents of a room occupies only an inferior place when estimating for large rooms and halls, and no place at all in figuring for small or ordinary office rooms or residences, which are heated from day to day throughout the winter.

Suppose a small room on the second floor of a three story building with only one outside wall, with no windows, but the whole furred, lathed, and plastered, with all the other rooms of the building heated and maintained to 70° Fah.; now place a portable heater in this room and keep it there until the room is heated to 70° also, then remove it. How long will it take to cool 10°? Answer, perhaps three hours. Now make a window without blinds, and you find it cools 10° in less than half the time. Why? Because the glass of the window being a good transmitter of heat, it is able to cool more air than the whole outside wall. You may now say: What about the inside walls and floor? Why, they actually help to maintain the heat in the room by conduction, etc., from the other rooms.

Thus the windows are the first and most considerable item. Secondly, the outside walls, how they are plastered—whether on the hard walls or on lath and furring. Thirdly, the prospect—whether exposed or sheltered. Fourthly, is the whole house to be heated, or only part of it? and, lastly, what the building is to be used for.

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES, COMPARED WITH EACH OTHER.

| | |
|---|---|
| Window glass | 1,000 |
| Oak and walnut | 66 |
| White pine | 80 |
| Pitch pine | 100 |
| Lath and plaster | 75 to 100 |
| Common brick (rough) | 120 to 130 |
| Common brick (whitewashed) | 125 |
| Granite or slate | 150 |
| Sheet iron | 1,030 to 1,110 |

In figuring wall surface, etc., multiply the superficial area of the wall in square feet by the number opposite the substance in the table, and divide by 1,000 (the value of glass), the product is the equivalent of so many square feet of glass in cooling power, and may be added to the window surface and treated the same.

The following method has given good results and is not wholly empirical. The writer has used it for many years in preference to any other:

CLOCK OF AUSTRIAN DESIGN.

Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere, by the difference between the temperature of the steam pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof, of plate or pipe surface to each square foot of glass or its equivalent in wall surface.

Thus: Temperature of room, 70°; less temperature outside, 0°; difference, 70°. Again: Temperature of steam pipe, 212°; less temperature of room, 70°; difference, 142°. Thus: 142÷70=0·493, or about one half a square foot of glass-heating surface to each square foot of glass or its equivalent. For each additional mile and a half in the average velocity of the wind above fifteen miles per hour add ten per cent to the heating surface.

In isolated buildings exposed to prevailing north or west winds there should be a generous addition of the heating surfaces of the rooms on the exposed sides, and it would be well to have it in an auxiliary heater, to prevent over-heating in moderate weather.

In windy weather it is well known to the observant that the air presses in through every crack and crevice on the windward side of the house; and should they take a candle and go to the other side of the house they will find that the flame of the candle will press out through some of the openings. Thus the air in a house blows in the same general direction as the wind outside, and forces the warmed air to the leeward side of the house; this is why the sheltered side of a house is often warmer in windy weather.

Conditions which tend to the warmth of a house in windy and cold weather without stopping the leakage of air under doors or around windows are: 1st, blinds on the windows inside; 2d, blinds on the windows outside; 3d, window shades and curtains; and, last, papered walls. The leakages are really blessings in disguise in houses which are not systematically ventilated.

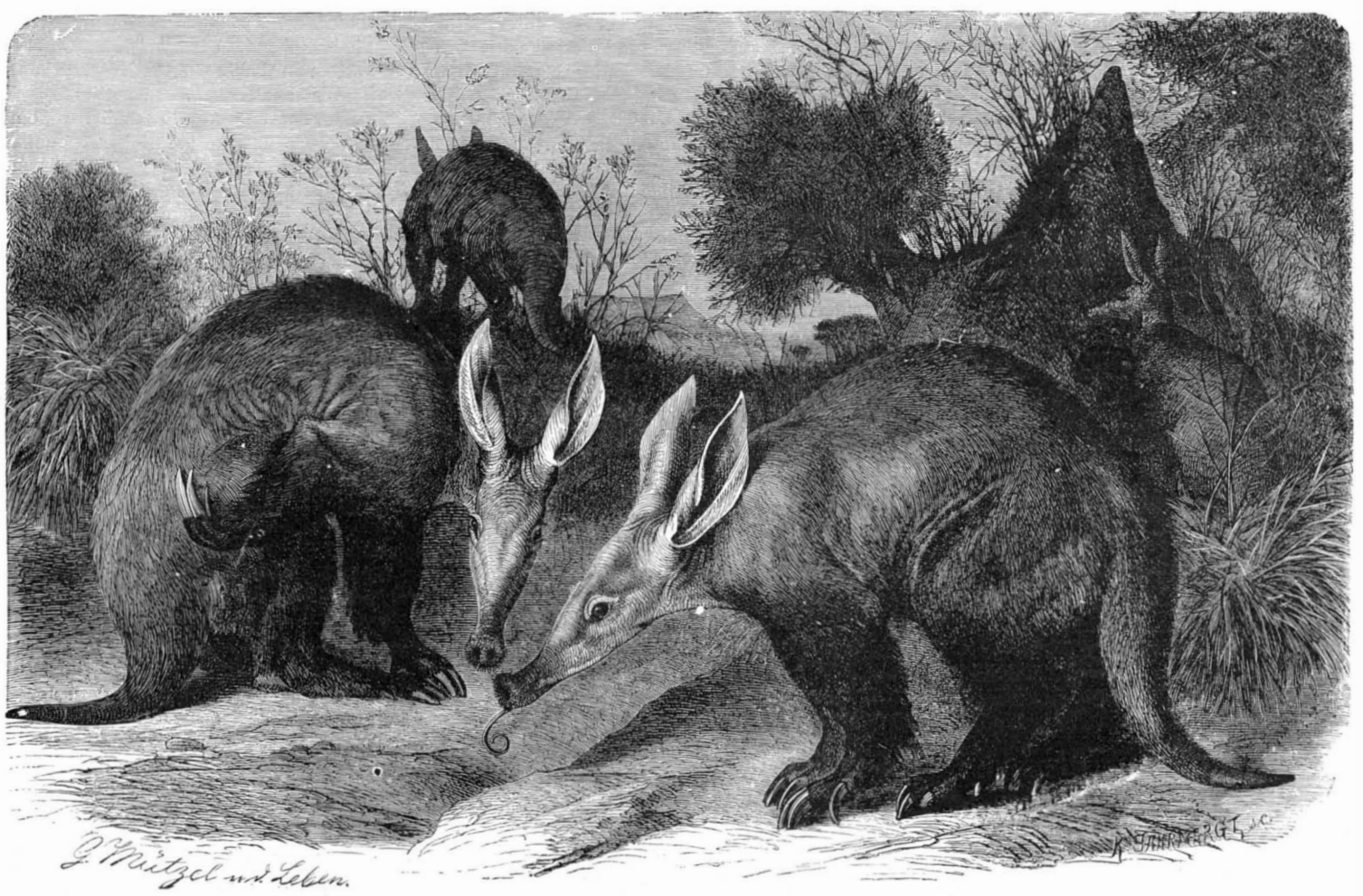
Lead or zinc paint should not be used on heaters; several coats of lead paint may destroy their heating power from fifteen to twenty per cent. Ocher and oil, or varnishes mixed with color, are the least harmful.

## A NOVEL CLOCK.

On this page we illustrate a handsome clock of Austrian manufacture, which makes no pretense of being anything other than what it is, and in which the design and ornament are studied with due reference to the use for which it is intended. The simplicity of the design is offset by elaborateness in the detail of the decoration, which is rich and well conceived. In the panels of the dome is some very fine work. Above the dome is an open belfry, containing a bell and hammer. With this arrangement the vibration of the metal, when the hours are struck, is not muffled, but rings out clearly and with distinctness. Another feature, companionable or distracting, according to one's mood, is the pendulum swinging across the face of the dial, attracting the eye by its mute motion to the ever-advancing hands and to the significant legend inscribed above them.

## THE AARD VARK.

The aard vark, or earth hog, is a native of Southern Africa, and is a very curious animal. The skin of the aard vark is not protected by scales or plates like those of the



AARD VARK.—*Orycteropus Capensis.*

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manis and the armadillo, but rather thinly covered with coarse bristly hair. Its length is about five feet, the tail being twenty inches long, and it is a very powerful creature, especially in the fore limbs, which are adapted for digging, and are furnished with strong hoof-like claws at their extremities. These claws can be used with marvelous rapidity and force, and are employed for the purpose of destroying the dwellings of the ants on which the aard vark feeds, as well as for digging a burrow for its own habitation.

The burrows are not very deep, but are of tolerably large dimensions, and are often used, when deserted, as extempore tombs, to save the friends of the deceased from the trouble of digging a grave for their departed comrade. The creature makes its burrows with marvelous rapidity, and can generally dig faster with its claws than a man with a spade.

The aard vark is a nocturnal animal, and can very seldom be seen during the day time. At night it issues from its burrow, and making its way toward the ant hills begins its work of destruction. Laying its fore feet upon the stone-like walls of these edifices, the aard vark speedily tears them down, and as the terrified insects run about in the bewilderment caused by the sudden destruction of their tenements, it sweeps them into its mouth with rapid movements of its long and extensile tongue. This member is covered with a tenacious glutinous secretion, to which the ants adhere, and which prevents them from making their escape during the short period of time that elapses between the moment when they are first touched and that in which they are drawn into the mouth.

### Trapping Rats.

A Wisconsin correspondent of the New York *Tribune* gives the following mode which he has successfully adopted:

Having lured to destruction many old Solomons among rats, I will detail my plan: Take a pan nearly full of bran, set a small steel trap without any bait, put a light wad of tow or cotton under the pan of the trap, which press down so it is just ready to spring; put the trap in the bran, making a place with the hand, so that it may be below the surface when level; lastly, scatter a few kernels of corn on the bran (pumpkin seeds are better), and you are ready for your victim. I hardly ever fail to fool some of the ringleaders in this way, while younger ones are easily caught. If "P." cannot thus circumvent that shy and cunning old specimen, I will give him my plan with strychnine, which is as swift with rats as with dogs.

So much for the Wisconsin rats. We cannot but think that the "old Solomons" out there are not half so wise or cunning as some we have encountered at the East. Some years ago the rats made bad havoc in our cellar, and we resolved to try the efficacy of the steel trap. It was set in a large flat vessel, and well covered and hidden with bran. We were more cautious than the writer above, for we used a large spoon to move the bran, fearing the rats might smell the touch of fingers and keep away. Small bits of cheese were then dropped over all parts of the bran and over the covered trap. The next morning there were tracks of rats all over the surface, *except where the trap was buried;* and the cheese was all taken, except directly *over the trap.* We were compelled to resort to a more effectual trap, which proved quite successful—in the shape of a fine old tom cat.—*Country Gentleman.*

### New Fossil Reptiles from the West.

The Yale Museum has recently received numerous remains of reptiles from the Jurassic deposits of the Rocky Mountains, and some of the more interesting dinosaurs are briefly described and figured by Prof. O. C. Marsh, in the current number of the *American Journal of Science and Arts.* These reptilian remains pertain to several distinct groups, and are interesting from the fact that they throw considerable light on the forms which have already been described from the same horizon.

Most of the animals described in the present communication belong to genera hitherto unknown. Of these new genera, the first (nearly allied to *Laosaurus*), which is called by Prof. Marsh *Camptonotus,* contains, as far as known, two species. *C. dispar* appears to have been a reptile about 8 or 10 feet in length, and herbivorous in habit. The fore limbs of the animal were much reduced in size; the massive portion was not in front, but behind, the ischium being larger than the pubis. All the specimens discovered are from the Atlantosaurus beds of the Upper Jurassic. The other species of this genus, *C. amplus,* was about three times as large as the one just mentioned, and is represented in the collection by various remains, among which is a left hind foot nearly entire.

*Brontosaurus excelsus* (new genus and new species), one of the largest reptiles yet discovered, has been recently brought to light, and a portion of its remains are now in the Yale collection. This monster, which was probably 70 or 80 feet in length, apparently belongs among the *Sauropoda,* but differs from any of the known genera in several important respects. The sacrum of the animal was 4 feet 2 inches in length, but had the striking peculiarity of being comparatively light, owing to the extensive cavities in the vertebræ, the walls of which were very thin. The remains of this gigantic reptile were discovered in the Atlantosaurus beds of Wyoming. Additional specimens of *Stegonosaurus,* including a new species (*S. ungulatus*) have been recently secured, and much new information in regard to the group has thus been obtained. These reptiles belong to the dinosaurs, but differ widely from any of the known sub-orders. The most striking character, to which the name refers, is the huge dermal plates which served to protect the animal. A number of these, from 2 to 3 feet in diameter, and others of smaller size, were found with the remains of the present species. The skull is very small, and more lacertilian than in the typical dinosaurs, and the brain cavity is remarkably small. The vertebræ known are all solid, and the fore limbs of the animal are shorter than those behind.

*Cœlurus fragilis* (new genus and new species) was a very small reptile, apparently a dinosaur, which left its remains in the same locality with *Camptonotus dispar.* The most characteristic specimens that have been obtained are vertebræ. Judging from what is known of the remains of this species, the animal appears to have been about as large as a wolf, and probably carnivorous in habit.

### Human and Canine Blood Corpuscles.

The question whether it is possible to distinguish between dog's blood and man's blood by microscopic measurements of their respective corpuscles was pretty strongly negatived by the evidence given in a noted murder trial by Dr. Woodward, of the Army Medical Museum at Washington. Dr. Treadwell, of Boston, had previously testified, in the same case, that he had identified certain blood stains on a pocket-knife as human blood by means of such measurements. Dr. Woodward, on the other hand, contended that such identification was impossible.

The corpuscles of the blood of man and dog vary within very wide limits, and corpuscles vary according to the health of the individual; a French investigator had discovered some in persons afflicted with anæmia as large as 1-551 of an inch; another 1-500; however the witness had never found one so large, his experiments giving measurements from 1-2500 to 1-4500; the corpuscles of dog's blood vary little from those of man's, but the largest or smallest sizes are not always to be found in any single drop from any animal; it has been claimed that there was no difference in the corpuscles of young or old; but Perrier, of Bordeaux, wrote in 1877 that the two extremes of size disappear as age advances and the corpuscles become uniform. Dr. Woodward had investigated this theory so far as it applied to man and the dog, and believed it correct; this applies to age; the variations caused by disease are yet an open question. Between the extremes all measurable sizes exist, varying even to millionths of an inch, the corpuscles in a drop of blood varying as much in size as different men do in a throng. Therefore when you try to get an average from four corpuscles or fifteen corpuscles you cannot do it any more than you can get the average size of men in a throng by measuring a few of them. Therefore it has happened that scientific men in their investigations do not get results comparing with each other; a noted investigator, Mr. Gulliver, in 1848 stated that the average size of man's corpuscles was 1-3200 of an inch, but Pellus and Franie, French investigators, found them slightly larger, and other Frenchmen found them smaller; what varies in nature must, of course, vary in the results placed upon paper, continued the witness, who admitted that he had never been able to get the same results from measurements of the corpuscles in two different drops.

At this point the witness referred to a paper written by him in 1875 for the *American Journal of Science,* and giving thirteen sets of measurements of human corpuscles; those of each set of 50 were averaged, he said, and the average of the aggregate was 1-3500 of an inch. These figures he had since criticised in print as being not absolutely correct, yet many European authorities still agree with them. Continuing, he remarked that as a drop of blood contains between five and six million corpuscles, in endeavoring to identify blood one must think of how many drops there are in a human body, and consequently how many millions of corpuscles. Hence we see how impossible it is to identify blood by measuring fifty corpuscles.

In reply to a question as to the relative sizes of dog's blood and human blood, Dr. Woodward detailed some recent experiments. One with forty corpuscles of the blood of one of his assistants in the Medical Museum in Washington, showed an average of about 1-3058 of an inch. Fifty corpuscles of dog's blood averaged only one millionth of an inch from the average of the forty of human blood above described. Upon the subject of restoring to their normal size for measurement the corpuscles of dried blood, Dr. Woodword said that there were numerous difficulties which tended to prevent accurate work. When restored they are generally smaller than their normal size, and would therefore appear to come within the ranges of the corpuscles of other species; the best restorative is that nearest approaching the serum of the blood, and that is the embryotic fluid surrounding the fœtal calf; glycerine with water gives good results in careful hands.

In reply to the question whether other diseases than anæmia affected the size of blood corpuscles, Dr. Woodward said: A statement is going the rounds of medical literature that all fevers do; however, one of my colleagues has examined the blood of a person who died of yellow fever and found no difference. The fifteen corpuscles discovered by Dr. Treadwell and testified to in the case under trial were within the range of human blood corpuscles, but they were also within the range of dog's blood.

Said the counsel: "You don't agree absolutely, doctor, with any of the line of eminent experts of Europe or America who were mentioned this morning?" A. "No, sir, for my own averages of measurements can never be made to agree."

"Why?"

"Because of the differences of the things measured—the corpuscles."

### The Most Northern Point of the United States.

BY WILLIAM A. MOWRY.

If the question were asked, Which is the most northern part of the United States, excepting Alaska? perhaps many would say, The line of 49° from the Lake of the Woods to the Strait of De Fuca. But that answer would be incorrect. There is a point where the United States reaches 49° 23′ 54″ north latitude. It is in longitude 95° 14′ 38″ west from Greenwich.

In other words, at the Lake of the Woods, in Minnesota, our territory includes a small area reaching beyond 49° more than 25 miles. This little excrescence, jutting out into British America, is recently put down upon some of our maps, but I have not seen it on many of them. It is indicated, though roughly, upon Case's large map of the United States and upon the large map published by the Government and issued by the Land Office. I observe it also in Warren's School Geographies.

The map which shows it most accurately is perhaps the Map of the State of Minnesota, published by the St. Paul Book and Stationery Company, at St. Paul. On most of the maps the Lake of the Woods is by no means correct, or even approximately so.

After learning the fact that our country does hold this little jutting piece of both land and water, the question arises, How did it happen that the boundary should take this circuitous direction? The answer is as follows: In the definitive treaty of Paris, signed (September 3, 1783) by John Adams, David Hartley, Benjamin Franklin, and John Jay, Article II. defines the boundaries of this country. In this article we find that from Lake Superior westward the boundary is given as follows:

"Thence through the middle of Long Lake and the water communication between it and the Lake of the Woods to the said Lake of the Woods; thence *through the said lake to the most northwestern point thereof,* and from thence in a due west course to the river Mississippi."

Evidently it was then supposed that the source of the Mississippi was to the north and west of this point. When, however, it was subsequently ascertained that the headwaters of this river were to the southward, the line was made to run from this "most northwestern point of said Lake" due south to latitude 49°.

We next find allusion to the matter in the treaty of "Amity, Commerce, and Navigation," signed at London (November 19, 1794) by Grenville and John Jay. The 4th Article proposes that, "Whereas it is uncertain whether the river Mississippi extends so far to the northward as to be intersected by a line to be drawn due west from the Lake of the Woods," measures shall be taken "to make a joint survey," and "the two parties will thereupon proceed to amicable negotiation to regulate the boundary line in that quarter."

By the 7th Article of the treaty of Ghent it was agreed to refer to commissioners "the boundary line from Lake Superior to the Lake of the Woods." In 1827 the commissioners made their final report, with maps of actual survey from Lake Huron to the Lake of the Woods. In this report they say:

"The extreme northwestern point of the Lake of the Woods is declared to be at lat. N. 49° 23′ 54″ and lon. W. 95° 14′ 38″; so that in conformity with the treaty this point, having been ascertained to be north of parallel 49°, a line is drawn due south from it to parallel 49°, on which parallel it is to be continued to the Rocky Mountains. No means have yet been taken to delineate the boundary westward from the Lake of the Woods."

The commissioners were Peter B. Porter and Anthony Barclay. No change was made from these agreements by the "Webster Ashburton Treaty" of 1842.

It is to be hoped that all future school geographies and larger maps will show this boundary.—*N. E. Journal of Education.*

### The Red Spot on Jupiter.

Recent communications to the *Astronomische Nachrichten* give further interesting details of the large, oblong red spot which may at present be seen so conspicuously on the southern portion of Jupiter's disk. According to Th. Bredechin, of Moscow, it is 16 seconds of arc long and 4 seconds broad, and lies about 9 seconds south of Jupiter's equator. It is surrounded with very brilliant white faculæ, which are especially conspicuous on its southern border.

According to Dr. Lohse, who has observed the spot since last June, it appears to lose in a considerable degree its intensity and color when near the planet's limb. He also sees the faculæ, spoken of above, and remarks at the preceding end of the spot a sort of grayish continuation, resembling in form an inverted comma.

This spot has not apparently diminished in intensity or size during many months—a fact which indicates considerable stability. As there is considerable probability that it will be visible another season, Dr. Lohse suggests that observations of its position will afford very valuable data for an accurate determination of Jupiter's rotation period. The sharpness of outline and regularity of form of the spot admirably adapt it for this purpose. The position of the spot

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should be fixed by estimation, its distance from the planet's limb being expressed in parts of the parallel of latitude passing through the spot, that is, in parts of the chord of the planet's disk drawn through the spot parallel to Jupiter's equator. Either end of the spot may be used for this purpose. The estimation made when the spot is near the center of the disk will be manifestly the most certain.

This is an opportunity that amateurs should not neglect, since the observations can be made with moderate telescopes and without a micrometer.—*Science Observer.*

### Fast Railway Speeds.

The speed of railroad trains in France, Germany, and the United States is still below that of several lines in England. The "lightning train" on the Paris-Marseilles line makes the distance of 539 miles between these two cities in 15 hours and 21 minutes, the average speed, including stoppages, being 35 miles an hour The express train on the Lehrter Railway runs from Berlin to Cologne at the rate of 37½ miles an hour, including stops, making the entire distance of 364 miles in 9 hours and 26 minutes. The Scottish mail leaves Euston Square at 8 50 in the evening and reaches Edinburgh at 6:45 the next morning. The distance is 401 miles, the time 9 hours and 55 minutes, the rate of speed, including stops, 41¼ miles an hour. The express from King's Cross runs to Edinburgh, a distance of 397 miles, in 9½ hours, or at the rate of 42 miles an hour, including stops. The fast train from Paddington to Plymouth, and the Irish mail from London to Holyhead, average between 41 and 42 miles an hour, or about the same as the Scottish trains. The fastest short-distance trains in Germany are that which runs from Spandau to Stendal, 57½ miles, without stopping, in 1 hour and 17 minutes, or at the rate of 45 miles an hour, and the express, which makes the distance of 88¾ miles, between Berlin and Magdeburg, in 2 hours and 7 minutes, or at the rate of 42 miles an hour, including two stops. In England a much higher rate of speed is attained on short distances. The Great Western trains run through from London to Swindon at the rate of 53 miles an hour, making the entire distance of 77¼ miles in 1 hour and 27 minutes, while nearly 50 miles an hour is made by the special express, which runs from London to Wantham, 105 miles, in 2 hours and 5 minutes. This is doubtless a much higher rate of speed than the usual schedule time on roads in the United States. The Washington limited express leaves New York at 10 A.M. and reaches Washington at 4 P.M. The distance, 230 miles, is made in 6 hours, or at the rate of 38 1-3 miles an hour, including stops. Between New York and Philadelphia but two stops are made; the rate of speed is 40 miles an hour. The Boston express, which leaves New York at 11 A.M., runs to Boston, 233 miles, in 7 hours and 11 minutes, which is about 32 miles an hour, including the six stops that are made. The special mail and express train on the New York Central and Hudson River road makes the distance at night between New York and Albany, 143 miles, in 4 hours and 5 minutes, or nearly 36 miles an hour. Only one stop is made. The Cincinnati express on the Pennsylvania Railroad leaves New York at 6 in the evening and reaches Pittsburg, a distance of 444 miles, at 8:30 on the following morning, and Cincinnati, 757 miles, at 8 P.M. of the same day. The rate of speed, including stops, is about 30 miles an hour between New York and Pittsburg, and 29 miles an hour between New York and Cincinnati. The distance between Harrisburg and Pittsburg, 249 miles, is run in 7 hours and 35 minutes, with three stops, or about 33 miles an hour. The fast line to Chicago by way of the Pennsylvana Road leaves New York at 9 A.M., and reaches Chicago at 7:20 on the following evening. The distance is 912 miles, the time 34 hours and 20 minutes, the rate of speed less than 27 miles an hour.

### Silk Woven Pictures.

It would almost seem that silk weaving has attained perfection in the marvelous pictures woven in silk by Mr. Thomas Stevens, of Coventry. Elegant designs in Coventry ribbons are familiar to all, many beautiful examples having won general admiration, but none excel the dainty silken pictures woven by Mr. Stevens' process. These pictures are comparatively small, and the subjects chosen are popular. Specimens may be seen in the shops of many stationers, and they form not only pretty but most unique and interesting wall decorations. Four subjects we have noticed illustrate the old stage coach, with horses, driver, guard, passengers, and luggage complete, and, in contradistinction to the primitive mode of traveling, there is the original locomotive engine, or "Puffing Billy," which laid up the old stage coach as a public conveyance, and terminated the "good old coaching days." A race for the blue ribbon of the Turf is vividly portrayed in silk, as is also "Dick Turpin's Ride to York." The specimens shown us were woven in the machinery department of the Fine Art and Industrial Exhibition held at York. These silk pictures are made in the largest known loom of its kind in the world—an admirable machine, which has taken medals at every exhibition wherein it has been shown, including the Philadelphia Centennial Exhibition, where, among thirty others (of all nationalities), it secured first prize. This extraordinary mechanical contrivance contains 160 shuttles, and will weave patterns in from eight to sixteen colors. The four subjects above mentioned contained ten and twelve colors, and it may be interesting to know that the pattern takes 5,000 perforated cards and 600 threads. As the loom makes twenty pictures at a time there are no fewer than 12,000 threads at work. A knowledge of these facts tends to make the Stevensgraph still more interesting, and demonstrates the vast amount of thought and labor entailed in the productions of pretty silk pictures, sets of which are very suitable for Christmas presents and New Year's gifts.—*British Trade Journal.*

### Stereoscopic Pictures.

Professor Steinhauser, of Vienna, has recently pointed out that there exists a determinate relation between the size and relative position of the two views of a stereoscopic picture, the lenses of the camera with which it is taken, and the optical arrangements of the stereoscope in which it is to be viewed. If these relations are observed rightly, the effect of relief will be much more perfectly attained for all parts of the picture than if they are neglected. The eye pieces of the stereoscope above the plane of the photographic pictures ought to be made as nearly as may be equal to the focal length of the objective of the photographer's camera, and this again should be about equal to the mean distance of easy vision, or, from ten to twelve inches. Herr Steinhauser, after developing the theory of the instrument in relation to this point, throws out three very definite and simple suggestions for the photographers. First, that all stereoscopic pictures should be taken with lenses of equal focal length, say five inches; secondly, that all should be made of equal breadth, or about three inches; thirdly, that the distances between the centers of the objective lenses should always be kept constant.

### The Okinawa Islands.

These islands have recently become a regular province or *ken* of the Japanese Empire, but are still a subject of serious controversy between Japan and China. Their ancient name was Liu Kiu, which has been corrupted by modern navigators into Loo-Choo, Lew Chew, and Lieou Kieou, and by the present natives into Doo-Choo; but the more musical name of Okinawa was given to them by the inhabitants themselves centuries ago, and the meaning of it is "the cord lying upon the sea." The entire group consists of thirty-seven islands, the largest of which is eighty-five miles long, by from three to twenty-three in width, and has a circumference of one hundred and fourteen *ri*, or about two hundred and seventy-eight miles.

During the whole of the eighteenth century the islands of Okinawa would seem to have remained in a state of perfect tranquillity. They continued to pay a double tribute to Japan and China, and having faithfully done so they felt that they had a right to bring in from abroad any new ideas that they might fancy. Hence they imported the paper mulberry from Japan, and began to manufacture paper; and from China they obtained the secret of making India ink, and also as an article of food when young, and for the beauty of its wood, they imported and cultivated the famous *moso* bamboo. They also adopted a code of criminal laws and of laws for reward, and not only established a national school, but many local schools in the various districts.

The peculiarities of the inhabitants of Okinawa may be summed up as follows: They are noted for their natural intelligence, though the majority have few opportunities for acquiring the knowledge contained in books; their language is closely allied to that of the Japanese; their occupations are chiefly agricultural, the leading productions being rice, wheat, sugar, millet, sweet potatoes, beans, peas, radishes, turnips, tobacco, cotton, indigo, and flax; their manufactures are limited to cloths made from cotton and grass, to porcelain and lacquered goods, and such other things as are needed for a simple rural population; the men are generally stout, well formed, and fond of wearing beards; the women are small, and kept in a low social position; all classes are industrious and neat in their persons and habitations; their style of dressing is Oriental, and suited to the climate; their homes are comfortable and picturesque; the table and household customs are similar to those of the Japanese; in religion they are generally Buddhists, although some of their rites are peculiar to these islands.

They know not what it is to have an army, nor any such offspring of civilization as a political demagogue; their policy is to carry on their public affairs in a spirit of courtesy and kindness. When they have deemed it necessary to carry guns on their little vessels, they have borrowed them from Satsuma. They use the Japanese alphabet, and write after the manner of their neighbors and protectors; and in speaking of their language they claim that six-tenths of the words are Japanese, three-tenths a local dialect, and one-tenth Chinese. When any public business is to be transacted, the people are called together in their several districts, and the men in authority accomplish the purposes of the government by kindly admonitions.—*International Review.*

### Production of Phosphorescent Powders.

The patentees of this process (Prince Sagan, W. F. McCarty, and E. Peiffer) employ a mixture of 100 parts carbonate and phosphate of lime (obtained by the ignition of shells, especially *Tridama* and *Sepia*) with 100 parts quicklime, 25 parts of calcined salt, and 25 to 50 per cent of the whole mass of sulphur; 6 to 7 per cent of a coloring matter —a sulphide of calcium, strontium, barium, magnesium, aluminum, etc.—must then be added. This powder serves to render barometers, compasses, etc., luminous, and is particularly phosphorescent under the influence of an electric current.

### Artificial Indigo.

At a recent meeting of the Chemical Society, London, a paper was read "On Alizarin Blue," by G. Auerbach. About eighteen months since a blue coloring matter was brought into the market as a substitute for indigo; it is now disused on account of its high price and its unstable nature when exposed to sunlight. The researches contained in this paper were finished in May, 1878. The author gives a *résumé* of previous work on the subject, and recommends the following method of preparation: 1 part of dry mononitroalizarin, 5 parts of concentrated sulphuric acid, and 1½ parts of glycerine, sp. gr. 1·262, are mixed and heated gently. Reaction commences at 107° C. and becomes violent, the temperature rising to 200° C.; much frothing takes place, with evolution of sulphurous acid and acrolein. The whole mass, when frothing has subsided, is poured into water, boiled up, and filtered, the residue being boiled out three or four times with dilute sulphuric acid. The mixed filtrates are allowed to cool, and the blue separates in brown crystals. These are purified, by mixing with water, and adding borax till the solution becomes brownish violet; the blue with the boric acid forming an insoluble compound. This residue is washed, decomposed with an acid, and the pure blue obtained as a violet silky paste. If required perfectly pure, it must be crystallized successively from its various solvents, high-boiling naphtha, amylic alcohol, and glacial acetic acid. When pure it forms brown shining needles, melting at 268–270°; it has the formula $C_{17}H_{11}NO_4$; salts were prepared and analyzed, but the results were not satisfactory, as it was difficult to obtain them quite pure; bromine derivatives were also prepared and examined. The action of chlorine, zinc dust, acetic anhydride, etc., have also been studied. The author discusses the constitution of the blue, and thinks it must be closely related to the aldehydines discovered by Ladenburg, which are formed when aromatic orthodiamides act upon aldehydes.

### Mineral Tanned Leather.

An account of a new process of mineral tanning, patented in Germany by Dr. Chr. Heinzerling, of Frankfort-on-the-Main, was described in the last volume of the SCIENTIFIC AMERICAN, page 234.

Referring to that article, Messrs. Wirth & Co., of Frankfort, write that there are now eight tanneries using this process in Germany, their leather everywhere meeting with approval. The leather is impervious to water, and its durability is said to be much greater than that of leather as ordinarily tanned. For example, a pair of shoes were made, the right with a mineral tanned sole, the left bark tanned. These shoes were subjected to natural wear, and when the left was worn out the right sole was uninjured. Trials made by the spinning mill of Jüngst & Co., of Biederkopf, within the past year, showed that belts of mineral tanned leather were not only better, but 30 per cent cheaper, than others. It is worthy of note that this method of Dr. Heinzerling is radically different from Prof. Knapp's method of iron tanning, and presents none of the objections which make the latter unsatisfactory.

### Fur on the Tongue.

One of the marked symptoms of certain diseases is a thick coating or "fur" on the tongue. In a recent paper before the British Royal Society, Mr. H. T. Butlin, F.R.C.S., described this fur as consisting chiefly of (1) *Débris* of food and bubbles of mucus and saliva; (2) Epithelium; (3) Masses which appear at first to consist of granular matter, but which are the glœa of certain forms of schistomycetes. That the last named of these three is the essential constituent is proved by the fact that the quantity of the glœa corresponds roughly with the quantity of fur present, and that its position upon the tongue corresponds exactly with that of the fur, both covering the tops of the filiform papillæ, but not usually lying between them. In order to ascertain the true nature of the glœa, and to obtain it in a purer form, it was cultivated upon a warm stage. Several fungi were discovered, but only two of these were present in every instance, *Micrococcus* and *Bacillus subtilis;* and, as the glœa produced artificially was similar to that existing naturally in the tongue fur, it is believed that fur is composed essentially of these two fungi. *Micrococcus* developed freely and abundantly, forming large masses of yellow or brownish yellow color. *Bacillus* did not develop, but existed in greater or less abundance in all the cases examined. Its development was probably prevented by the presence of other developing organisms, from which it was found impossible to separate it. It appeared to be identical with the *Leptothrix buccalis* of Robin. Although it did not develop under artificial conditions, it is probable that development takes place freely upon the surface of the tongue Its habitual occurrence there and the presence of spore bearing filaments favor this view. Besides these fungi there were present, more or less constantly, *Bacterium termo, Sarcini ventriculi, Spirochæta plicatilis,* and a larger form of *Spirillum* (or rather *Vibrio*). *Sarcini ventriculi* was frequently present, and generally developed quickly, forming large masses of a yellow or yellowish brown color. *Spirochæta plicatilis* occurred only in two or three of the specimens examined. *Bacterium termo* existed in some of the furs, and twice developed with such rapidity that the whole of the fluid was crowded with these organisms. The slime between and around the teeth was found to consist of the same fungi as the tongue fur, but the rods of Bacillus were longer, probably owing to the disturbing causes being fewer.

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### Contagion.

Contagion consists physically of minute solid particles. The process of contagion consists in the passage of these from the bodies of the sick into the surrounding atmosphere, and in the inhalation of one or more of them by those in the immediate neighborhood. If contagion were a gaseous or vapory emanation, it would be equally diffused through the sick room, and all who entered it would, if susceptible, suffer alike and inevitably. But such is not the case; for many people are exposed for weeks and months without suffering. Of two persons situated in exactly the same circumstances, and exposed in exactly the same degree to a given contagion, one may suffer and the other escape. The explanation of this is that the little particles of contagion are irregularly scattered about in the atmosphere, so that the inhalation of one or more of them is purely a matter of chance, such chance bearing a direct relation to the number of particles which exist in a given cubic space. Suppose that a hundred germs are floating about in a room containing two thousand cubic feet of air. There is one germ for every twenty cubic feet. Naturally the germs will be most numerous in the immediate neighborhood of their source, the person of the sufferer; but, excepting this one place, they may be pretty equally distributed through the room, or they may be very unequally distributed. A draught across the bed may carry them now to one side, now to the other. The mass of them may be near the ceiling, or near the floor. In a given twenty cubic feet there may be a dozen germs, or there may be none at all. One who enters the room may inhale a germ before he has been in it ten minutes, or he may remain there for an hour without doing so. Double the number of germs and you double the danger. Diminish the size of the room by one half, and you do the same. Keep the windows shut, and you keep the germs in; open them, and they pass out with the changing air. Hence the importance of free ventilation; and hence one reason why fever should be treated, if possible, in large airy rooms. Not only is free ventilation good for the sufferer, but it diminishes the risk to the attendants.—*Nineteenth Century.*

### New Process of Gilding Glass.

We translate from a late issue of the Dresden *Glasshutte*, says the *Pottery and Glassware Reporter*, the following concerning a new chemical process for gilding glass discovered by Mr. Mayan, which will be of interest to our manufacturers of ornamental glassware. The glass, it will be observed, is gilded by bringing it in contact with a bath containing a solution of gold, the composition of this bath conditioning several reactions in order that the gold may settle upon and become firmly attached to the glass. The bath consists of—

1. A solution of gold.
2. A solution of caustic soda.
3. A reagent.

The first of these is obtained by dissolving chemically pure gold in muriatic acid. This solution is then evaporated until a perfect crystallization is secured. The gold crystals thus obtained are dissolved in water in the ratio of six or seven grammes to one liter of distilled water, and filtered until perfectly pure.

For the second solution forty grammes of caustic soda are treated with alcohol or lime, dissolved in one liter of distilled water, so that the solution shows seven or eight degrees of caustic soda. Although a greater or less portion of gold or alkali does not affect the operation materially, the proportions given are those which have proven themselves practically the most economical both in regard to the ingredients and rapidity of the process.

Four fifths of the gold solution and one fifth of the caustic solution are then mixed, and to one liter of this mixture is added one of the reagents in the following proportions:

1. Three cubic centimeters of concentrated and chemically pure glycerine, mixed with the same quantity of distilled water, with the above mentioned caustic solution, form the most energetic reagent.

2. Five cubic centimeters of 90 per cent alcohol mixed with equal parts of glucose solution, the latter being prepared by taking twenty grammes of glucose to 100 grammes of distilled water, and boiling the mixture down to about fifty grammes. This reagent gives the gilding a reddish color.

3. Thirty cubic centimeters of a mixture of 90 per cent alcohol and the following solution of sugar: Dissolve twelve grammes of white sugar in 100 grammes of distilled water, add two grammes of nitric acid of 1·34 specific gravity, and let the whole boil for fifteen minutes. Of this and the alcohol equal weights are mixed.

4. Forty cubic centimeters of aromatic alcohol—butyl, propyl, or amyl-alcohol answers the purpose best. This reagent gives the gilding a peculiar brilliancy.

5. Forty cubic centimeters of brandy made of fruit juice or sugar cane.

Although the quantity of the reagent to be added need not correspond exactly with the proportions given above, it is to be understood that certain limits are not to be overstepped. One would, for instance, fail in the operation if, instead of three centimeters of glycerine, twenty grammes should be taken.

The reaction or gilding begins as soon as the different elements of the bath are united. The setting of the gold occurs in every direction, but it can only be used when it acts upward; therefore the article to be gilded must be placed in such a position that the gold will touch the parts to be gilded in the direction mentioned. A glass plate to be gilded, for instance, must be allowed to swim on the bath. No deviation from this rule will be followed by success. As soon as the gilding is sufficiently strong, the article is taken from the bath, rinsed with pure water, thoroughly dried, and coated with varnish. In order to make the gilding more durable, use a varnish made of a glass enamel easily vitrified, or of enamel colors, afterward burning it in a muffle.

### A Novel Experiment.

A pretty illustration of the extent to which practical demonstration is sometimes carried in popular scientific lectures was given in the crowded hall of the Cooper Institute, in this city a few evenings since. It was nothing less than the measurement of the velocity of a rifle ball fired across the stage, in the course of a lecture on projectiles by Professor Robert Spice, of Brooklyn.

The distance measured on the platform was only thirty-three feet, the ordinary distance used in determining this question being about 200 feet. The co-operation of Lieutenant E. L. Merriam, of the Brooklyn 13th regiment, had been secured for the experiment. There was provided a mahogany base, 12 inches by 15 inches, on which were placed two levers which carried bent wires to make marks on a piece of smoked glass underneath the points. One of these wires was connected with a pendulum attached to an Atwood machine, vibrating seconds. By means of electric currents the lever connected with the pendulum came down on the glass precisely at the beginning of each second, making a series of lines separated by spaces somewhat similar to the old Morse alphabet. Consequently the distance from the beginning of one line to the beginning of the next represented a second of time.

The second lever, exactly opposite, had a spring attached to one end, which kept the point off the glass. It also had two electro-magnets, one at each end, which had electric currents passed through of different strength—the weaker current tending to pull the lever down on the glass; the stronger current tending to keep it elevated. In addition to this, the current from the stronger magnet passed through a loose wire resting on two globules of mercury, and immediately in front of this wire was to rest the muzzle of the rifle. The weaker current passed through a precisely similar loose wire, also on two globules of mercury, which wire was placed thirty-three feet distant from the first wire. Lieutenant Merriam's part was to shoot away the wires on the mercury. He used a regular Creedmoor rifle, 45 caliber, 34 inch barrel, loaded with 45 grains of powder (a light charge) and a 450 grain ball. The pendulum was set in motion. On its striking the fifth second the plate of smoked glass was drawn along by the descent of a weight on the top of a column of sand which ran out of a tube. On the sixth second, Lieutenant Merriam pulled the trigger and both wires vanished. On the first wire being broken the point of the corresponding lever descended on the glass, but immediately arose again by the action of a spring, when the bullet broke the second wire. The consequence of this was that the point connected with this lever scraped a very short line on the smoked glass; while the other point, being kept down during the swing of the pendulum, scraped a longer space.

Then the glass was withdrawn and placed in the stereopticon, projecting a magnified image of the lines on the screen. The relative lengths of these lines were ascertained, thus obviating any source of error in measuring the minute lines on the smoked glass. This method of measuring the lengths was claimed to be original by the professor.

The longer line was found to have the length of 110 inches; the shorter 5 inches; making the duration of the flight of the ball 5-110 or 1-22 of a second. Hence its rate of motion was $33 \times 22 = 726$ feet a second.

### Corn Malt.

In consequence of the great scarcity of good malting barleys, fresh attention is sure to be directed to the manufacture of maize malt, and we see no reason why a really good brewing material should not be obtained from this grain. One of the principal practical difficulties in the way of malting maize is due to the fact that its husk is so thin, and therefore the grain is very liable to be damaged on the floor. The application of the pneumatic system would probably surmount this difficulty, and we should be glad to hear of some attempts to malt maize in a malting built on the new system. The husk of maize contains a peculiar yellow oily body which is liable to impart an unpleasant flavor to beer, but this may be counteracted to a great extent by repeatedly changing the steep liquor. Maize costs now about 30s. per quarter, which price compares favorably with that of good barley, and only a few practical difficulties require to be surmounted to produce a good malt from this grain; we therefore anticipate it will come more and more in use for this purpose.—*Brewer's Guardian.*

### Long Distance Walking.

The six days' walking match which ended in this city Dec. 27 was remarkable, not only for the long distance covered by the winner, but for the number of competitors who covered or exceeded 500 miles. The winner, Hart, made 540 miles; the other distances were 534, 531, 527, 520, 520, 502, 500 miles; eight other competitors equaled or exceeded 450 miles.

### Geology of the Rocky Mountains.

Since his return to Edinburgh, Prof. A. Geikie has given to his classes in the university of that city an account of his last summer's observations and studies in connection with Rocky Mountain geology.

He had three objects in the expedition: (1.) To study the effects of atmospheric agencies and of erosion generally upon the surface of the land; and there was no region where those lessons could be learned with more powerful impressiveness than in those great plateaus and table lands. (2.) To study the relation which the structure of the rocks underneath bore to the form of the surface. In this country and in Europe generally one was continually brought face to face with evidence of dislocations, protrusion of igneous rocks, faults, and so on, which greatly complicated the geological structure, and made it sometimes by no means easy to tell how far the present irregularities of the surface were due to unequal waste of surface, and how far to the direct effects of underground causes. The western regions of America, which retained to this day for thousands of square miles the horizontality which they had originally, presented wonderful facilities for the discussion of this subject. (3.) To watch with his own eyes some of the last phases of volcanic action. He had been familiar with this as displayed in Italy and in the Lipari isles; but he was anxious to see some of those marvelous evidences of the gradual wearing and decay of a vast volcanic area which were so well seen in the famous region of the Yellowstone.

#### CHARACTERISTICS OF THE ROCKY MOUNTAINS.

The professor went on to give a brief account of his journey, mentioning that in crossing the prairies toward the Rocky Mountains, he noted, in a few sections that occurred, soft, gray clays and marls, evidently cretaceous, and sometimes tertiary rocks. Getting down at some of the stations, and looking at the ant hills and burrows of the prairie dog, he found that the surface of the prairie was veneered with a thin coating of pinkish, fine grained sand, sometimes approaching to gravel, its color being due to the presence of a great many small pieces of fresh feldspar. It was clear that this mineral, as well as the quartz and fragments of topaz which he saw, did not belong to the strata in which they lay. In going west, the grains of sand began to get coarser, and assume the form of distinct pebbles, till, when he reached the mountains, these became huge blocks and bowlders, evidently derived from the hills in their neighborhood. After submitting that the phrase "Rocky Mountains" was a very unfortunate one, as applied to the great number of independent ridges comparable to waves that covered this part of America, the professor said that he halted for a little while on the flanks of the first great mountain ranges—those that formed the colossal bulwarks of Colorado. As seen from the prairies they form a very picturesque line of peaks. They had been pushed as a great wedge through the rocks forming the prairies, and had carried those rocks up with them. Crystalline masses formed the central core and crest of the range, and this feature was combined with some very interesting facts connected with the surface erosion of the district. He found then where all the pink feldspar and gravel had come from; it had been borne down from this region, where great masses of pink granite, gray gneiss, and other crystalline rocks formed the core of the mountains. He found that the mountains themselves had been covered with glaciers, which had gone out into the plains and shed their huge horseshoe-shaped moraines where now everything was parched and barren. Having crossed the watershed of the Rocky Mountains, he struck westward into the Uintah, one of the few ranges in that region that had an east and west direction. The central portion of this range consisted, not of crystalline rocks wedged through the older rocks, but of carboniferous rocks that had been upraised as a great flat dome, and had been above water for a very long time. This carboniferous center was particularly interesting from the fact of its presenting the strata perfectly horizontal. They could be seen, terrace after terrace, for miles, and it could be noted whether or not they had been cut through, by faults, to what extent they had been twisted, and to what extent eroded by atmospheric influences. Getting on the tops of these great mountains, he could see that the strata were almost entirely horizontal for miles, and that the valleys had been trenched out of them, not by means of faults at all, but actually by erosion of the surface. He found also that the numerous lakes were true remains of erosion, that they had not been formed by any subterranean movements, but actually gouged out by the ice that once covered those mountains. Striking into one of the valleys, he found beautiful horseshoe moraines. These had gone across the valley and formed a succession of lakes; while the beavers had made a great many more lakes in places not reached by the moraines. In most of these valleys there were hundreds of acres of bog land, entirely due to the damming of the waters by the beavers. The plains in the neighborhood of the Uintah Mountains were called "bad lands," because they were crumbling down under the action of the weather, and nothing would grow upon them. A skeleton found in a hill of that district was brought to Professor Marsh, and turned out to be the bones of an extinct and undescribed reptile.

#### VOLCANIC REMAINS IN THE YELLOWSTONE COUNTRY.

From the Uintah Mountains Professor Geikie found his way north into the Yellowstone country, and examined the fading traces of volcanic action. The volcanoes seemed in that region to have confined themselves very much to the valleys. The heights on either hand consisted of crystalline

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rocks; the bottom of the valley had been literally deluged with sheets of lava. These were examined with considerable care. In the course of the examination, huge mounds of gravel and stones were met with, which, at the first glance, were evidently moraines. The first was marked by a huge block of rock, an erratic of coarse granite, different from the rocks round about. Such blocks he found to increase in number as he went up the valley; and on entering the second cañon, or gorge, he found the sides exquisitely glaciated. It was clear, therefore, that not only was this second cañon old; it was older than the glacial period; it supplied a channel for the glacier that ground its way out from those mountains. Endeavoring to estimate the minimum thickness of the ice, he traced striæ up to 1,000 feet, and they evidently went higher than that. But in going farther up the valley, he found that the erratic blocks of granite and gneiss dropped by the glacier as it melted went far above the 1,000 foot limit; he got them on the shoulder of one of the great hills overlooking the valley 1,600 or 1,700 feet above the bottom of the valley; the ice, therefore, must have been 1,600 or 1,700 feet thick. It thus appeared that not only did those mountains possess glaciers, but some of these were of such thickness as to deserve the name of ice sheets, covering the whole surrounding region. As to the volcanic phenomena of the district, he saw evidence of a long series of eruptions, one after another, separated by prolonged intervals, during which the river was at work cutting out the older lavas, the newer lavas filling up the hollows eroded by the river. In the grand cañon of the Yellowstone he saw the most marvelous piece of mineral color anywhere to be seen in the world. It was cut out of tuffs of lavas, showing sulphur yellow, green, vermilion, crimson, and orange tints, so marvelous that it was impossible to transfer them to paper.

### THE GEYSERS.

Leaving the Yellowstone Valley, he struck southwestward into the famous geyser regions, where a number of geysers had been made known of late years more wonderful than those of Iceland. He tried hard here to get a pool to wash in, but could find nothing below 212°, and the only chance of getting a bath was to get into some hole where the water had had time to cool after flowing out of the hot crater. The whole ground was honeycombed with holes, every one of which was filled with gurgling, boiling water. Some went off with wonderful regularity, others were more capricious; and the chief geyser, which threw up an enormous body of water and steam, was very uncertain in its movements. In one part of the district he came upon a marvelous mud spring, the center of it boiling like a great porridge pot full of white and very pasty porridge. Steam rose through this, and, after forming great bubbles, burst, the mud thrown out forming a sort or rim round the crater. After describing a meeting with Indians on their way to a great council, the professor said his road after that lay across what he supposed was one of the most wonderful lava fields in the world—hundreds and thousands of square miles of country—a sort of rough plain—having been absolutely deluged with lava. How this lava was poured out he at present could hardly tell; it seemed to have risen through long fissures, and spread out so as to fill a vast area. Here and there along the margin of it were distinct volcanic mounds, apparently formed during later stages of its volcanic history.

### THE VICINITY OF SALT LAKE.

Coming at length to the Salt Lake territory, one of the first geological features that struck him was the evidence for the former vast expansion of the Salt Lake. He found traces of a terrace well marked along the sides of the mountains, about 1,000 feet above the present level, and so succeeded in discovering what was the relation between the extended lake, which must have been a great many times larger than the present one, and 1,000 feet deeper, and the glaciers which at one time covered the Wahsatch and the Yellowstone Mountains. Striking into some of the cañons descending from the Wahsatch into the Salt Lake basin, he found evidence of wonderful glaciation. The rocks were smoothed and polished and striated by the glaciers that had come down from the heights, and these glaciers had carried with them great quantities of moraine matter. Huge mounds of rubbish blocked up the valleys here and there, and these mounds came down to the level of the highest terrace. That was to say, that, when the Salt Lake extended far beyond its present area, and was over 1,000 feet deeper than now, the glaciers from the Wahsatch Mountains came down to its edge and shed their bergs over its waters. On his return journey the professor resumed the examination of the prairies. Coming out of the Colorado Mountains, he noted, in connection with the gravel formerly observed, great quantities of a peculiar gray clay. This clay was interstratified with the gravel, and here and there contained a small lacustrine, or terrestrial shell. It was, therefore, a fresh water deposit, a deposit swept by the waters coming down from the mountains over the prairie; and marked an interval in the period during which the gravel and sand were being thrown down. He traced the gravel mounds over an extensive tract, and he found the gravel had been deposited irregularly, just as would have been the case from the action of water escaping from the melting ends of the ice. A great current would traverse the plain in one direction, then the ice mass would send water in another, so that the whole prairie must have been flooded with water derived from the melting ends of the vast sheets of ice. It was those excessive floods that brought down the gravel and sand; and during that time there were intervals when nothing but the finest mud was coming down, just as was seen in the valley of the Rhine and Danube.

## The Geodetic Survey of the Great Lakes.

A great deal of curiosity having been excited in the eastern part of Illinois with regard to certain pyramidal structures in that region, the meaning of which the average citizen could not make out, Professor J. O. Barker, of the State University, rises to explain. They are observatories built by the United States lake survey, and are a part of a chain of such stations extending from near Chicago to the Ohio and Mississippi Railroad near Olney, Ill. For many years past the War Department has been engaged in making a very accurate survey of the shores of the great lakes. The method is that known among engineers as a trigonometrical or triangulation survey. This consists in measuring very carefully a line five or six miles long, called a base. From the extremities of this line angles are measured to distant signals erected for the purpose. Then, having measured one side and the angles by trigonometry, they calculate the distance from the base to the distant signals and also the distance between the signals. From these latter stations they measure angles to still other stations, and so continue until they have spanned the whole section to be surveyed with a network of triangles, whose sides are ten, twenty, thirty, and sometimes as much as a hundred miles long. When a map is desired, numerous smaller triangles are measured inside of the larger ones, thus determining the position of a great many points very accurately. Near the close of the work another base line is measured to test the accuracy of the intervening operations. These bases are measured with apparatus constructed expressly for the purpose, and the degree of accuracy is most wonderful, the error often being no more than the sixteenth of an inch in a mile. This system of surveying is the most accurate known. In one instance the lake survey triangulated about three hundred miles with no greater error than four inches, and this is not an exceptional case.

In the beginning the object was a survey of the great lakes for the aid of navigation, and for this purpose the system of triangles was carried around the shores. In the prosecution of this work a line of triangles was extended from the north of Lake Superior to a few miles south of Chicago.

The lake survey having about completed the work for which it was organized, it was suggested by scientific men that the chain of triangles already referred to be extended south from Chicago for the purpose of measuring an arc of the earth's meridian. Astronomers and engineers determined the size and form of the earth by measuring a portion of the circumference. In scientific circles there has always been a great interest connected with the size and figure of the earth, and just now there is increased interest on account of the transit of Venus, which was so much written about in the papers a few years ago. Astronomers use the radius of the earth as the foot rule with which they measure the distance and sizes of the heavenly bodies.

Then, to get back where we started from, the work which the lake survey is now doing in our midst is the measurement of an arc of a meridian from which can be determined the radius of the earth. The structures which have caused so much inquiry among our farmer friends are the observatories built by the lake survey for the purpose of elevating their instruments and signals so as to get a better view of the distant targets.

Nearly all civilized countries have been engaged more or less in the determination of the figure of the earth. The methods and means used by the American coast and land survey are equal, if not superior, to any ever before used, and hence the scientific world waits with great interest for the results of our geodetic surveys. The United States has an enviable international reputation for the liberality and the skill with which our surveys have been conducted. Every American should feel proud of the distinction his country has thus attained.

People frequently ask of what practical benefit is all this. We reply that the principal object of the survey is as above indicated, that is, the advancement of pure science and to add to the sum total of human knowledge. It has nothing to do, as some seem to think, with the land survey. However, it could be utilized in this respect if Illinois should choose to make a trigonometrical survey of this State as has been done in several Eastern States. To some it may seem that the engineers are not very industrious, but such is not the case, since they can only do first-class work under the most favorable circumstances. It was the hope and intention to finish the field work last fall. The computations will take perhaps a year longer.

## New Kinds of Plated Sheet Iron.

In Iserlohn, Westphalia, thin sheet iron is plated with alloys of nickel or cobalt and manganese. A half of one per cent of manganese makes cobalt and nickel very malleable, fluid when melted, and ductile. The plates, which are already in the market, are beautifully white and brilliant.—*Metallarbeiter.*

## New Jersey's Silk Industry.

Statistics gathered for the forthcoming annual report of the New Jersey Labor Bureau include reports from sixty-seven silk mills, mostly in Paterson. The Paterson mills alone employ 10,000 hands, besides from 2,000 to 3,000 employed in their own homes. The annual production of these mills reaches the total of $14,000,000.

## MISCELLANEOUS INVENTIONS.

An improved instrument for mending harness and other articles, patented by Mr. Charles P. Adams, of Stockbridge, Mass., consists in a handle made of such a shape and size as to serve as a receptacle for various tools. It is made with a large central cavity, which is surrounded with a number of smaller cavities of suitable shape and size to serve as receptacles for a knife blade, a needle, a hook for removing stones from horses' feet, and other suitable tools.

Mr. Walter F. Jenkins, of Fithian, Ill., has invented an improved clothes pounder having a hollow stem made with an enlarged upper part and provided with a set of valves and partitions, so that the obstruction of one valve will not interfere with the working of the other.

Mr. Emery M. Hamilton, of New York city, has patented a T-square for use in making perspective drawings, whereby the mechanical difficulties connected with such work may be readily overcome. Heretofore in making such drawings, to avoid the tedious process of working by diagonals or by elaborate scales, whereby only an accurate perspective could be obtained, the draughtsman has usually made the vanishing point too close, so as to bring it within reach, or has selected a point of view with reference to the angle that will effect the same object, the result in either case being to cramp or distort the drawing. This invention consists in a T-square, fitted with a swinging blade, adapted for giving perspective lines vanishing either to the right or left at any distance. The blade is moved by an adjustable slide piece, that is attached upon the drawing board, so that by it a true and accurate perspective drawing may be made with facility.

Mr. Otto Ernst, of South Amboy, N. J., has patented an improved building for cremation purposes. The object of the invention is to associate the process of cremation with the usual practices at funerals; and the invention relates to the peculiar arrangement and construction of cremation furnaces, in connection with a building or temple.

All horses, when in motion, necessarily move the head independently of the body, which causes a jerk or pull on the driver's or rider's hand, and, the mouth of the horse being very sensitive, the effect is unpleasant to both driver (or rider) and the horse. This result is due to the want of elasticity of the reins, or what are in some localities denominated "lines." To remove the difficulty, Mr. Benjamin A. Davis, of Petersburg, Va., has patented lines provided with an attachment which renders them elastic within certain limits, or up to a certain degree of tension, but has no effect when such limit or degree is exceeded.

Messrs. William M. Smeaton and John Smeaton, of Newcastle Street, Strand, County of Middlesex, England, have patented an improved water closet valve mechanism adapted to be brought into operation by a pull or handle for the purpose of regulating the amount and preventing the waste of the water supplied to the bowl of a water-closet, to flush and cleanse it during or subsequent to use.

Messrs. Mortimer H. Bachman and Sebastian S. Peckinpaugh, of Stanton, Mich., have recently patented an improved process of photo-negative engraving, which consists in placing a mask over, but not in contact with, the negative previously developed by the usual process of photography, for the purpose of preserving intact any portion of the object upon the negative, while the remainder not wanted is obliterated by exposure to the light, and the negative subsequently finished in the usual manner and engraved by means of a sharp steel instrument, which cuts through the varnish and exposes the glass, so that whatever design is engraved will be printed along with the photograph.

An improvement in buckles has been patented by Mr. George G. Bugbee, of Gonzales, Texas. The invention relates to buckles for harness or other purposes, adapted for connection to a strap or billet without sewing; and the invention consists in a buckle having a rigid crossbar, that is formed with a loop or crank-shaped tongue, over which the billet or strap is placed to secure the buckle, and on which the swinging tongue of the buckle is secured, this construction rendering the buckle more compact and of better appearance than double tongue buckles as heretofore made, and giving a wider range of use for the buckle.

Mr. Henry Gottlieb, of New York city, has patented an improved billiard cue cutter, which consists of a cylindrical box, four or five inches long, or thereabout, bored throughout its length for the admission of the end of the cue. The box is divided longitudinally into halves that are hinged together at the lower end by an annular hinge, and are prevented from separating too far at the top by a slotted circular plate that is fastened on the top of one half and engages with staples on the other, and under this plate is secured a blade that projects horizontally part-way over the bore.

An improved Wagon Cover, patented by Mr. Thomas Danahey, of Council Bluffs, Iowa, consists in making a bow of two straight springs of equal length, and connecting them by a top hinge, while on the other side, opposite to the wings of hinge, are arranged two stops that abut together and limit the inward movement of the hinge ends of the spring toward each other.

Mr. Edward Clark, of Jersey City, N. J., has patented an improved composition for fire kindlers, composed of resin, lard, washing soda, flour paste, and sawdust.

An improved railway rail has been patented by Mr. Silas Nicholls, of Westminster, England. It consists in a rail, constructed of parallel lengths or half rails, of channeled iron or steel of ⊐ shaped section, bolted or riveted together, with their channeled sides outward, and with cast iron spacing blocks between.

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## Business and Personal.

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Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

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The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$275 Horizontal Engine, 20 H. P. See page 390.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 318.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

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Elevators.—Stokes & Parrish, Phila., Pa. See p. 29.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville N. J


## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) E. H. B. asks: How much bichromate of potash should be added to a given quantity of Indian ink for drawing purposes? A. Reduce a small quantity of the bichromate to powder and dissolve in a limited quantity of boiling water. There should be an excess of the salt beyond what is taken up by the water. When the solution has cooled, pour it off from the residue, and bottle. When required for use, dilute the solution with about one third its volume of water, and it is ready for use.

(2) A. R. asks: How can I prepare porous silica for polishing metals? A. An article similar to porous silica may be prepared by treating a strong solution of water glass (silicate of soda) with a small quantity of strong oil of vitriol. If the solution has been sufficiently strong, after standing a few hours in a warm place it will completely gelatinize. Wash this well with cold water, decant or filter off the washwater from the gelatinous silica (hydrated silicic acid), place the latter in a suitable vessel, and dry over a good fire.

(3) C. D. W. writes: 1. I am constructing an electric machine, from directions given in SUPPLEMENT 161. In making the patterns, divided the cross piece on top, in the middle, to save making two patterns Is there any objection to that? A. No. 2. Must the electro-magnets be finished? I pickled mine, and rubbed them up pretty well with an old file. A. The contact surfaces of the two parts should be well fitted to each other. Otherwise no finish is required. 3. On making the armature, I have got seven layers of wire, where there are but five in the engraving. Is this a fault? A. You can determine by experiment. Put a loop at the end of the fifth, sixth, and seventh layers, and vary the length of wire used until you get the best effect. 4. In making the commutator, I could not get vulcanite, so took a piece of apple wood and gave it several coats of shellac varnish. Will that do? A. Yes.

(4) W. W. N. writes: A dispute arose between two parties, they agreeing to leave the decision to your paper. A argues that the Pacific Ocean is higher than the Atlantic. Proof being the currents running from the Pacific to the Atlantic; and that if a canal be built through the Isthmus of Panama an immense current from Pacific to Atlantic will be the result, which will have to be counteracted by immense locks. B argues that the theory, "water seeks its own level," holds good for the oceans, and no such current will result. A. There is no difference at mean tide. The tides on the Pacific side are about three feet; on the Atlantic side they are five or six times as great.

(5) J. M. S. asks for a rule to figure the resistance caused by surface friction to a boat passing through the water. I don't mean displacement, but the friction of the water against the sides and bottom of the boat. A. There are no rules determined, suitable for practical application. The amount of resistance in each particular case depends upon: 1. The character and smoothness of the surface. 2. The length of body over which the water glides. 3. The velocity of the water over the surface of the body.

(6) C. C. writes: Having often heard the word "spiling" used by shipwrights in the phrase "taking a spiling," meaning the taking of the shape of any irregular surface as measured from a straight line by ordinates, will you please inform me if the word has any sanction of authority, as I am unable to find it in Webster? A. In "Knight's Mechanical Dictionary" for *Spiling:* the edge curve of a plank or strake. *Spilings:* dimensions taken from a straight edge or rule, to different points on a curve.

(7) E. C. B. asks: Has an alphabet of sound figures been established, so that speech may be readily read off from the phonograph or phonoscope, with or without a magnifying glass? A. No, the impressions vary too much with different voices.

(8) K. asks for a preparation to touch up black baked japanned goods which have been marred. The varnish should be applied with a brush. What black preparation can be applied to iron with a brush, which will have the appearance of black japan and will not wear off? A. Finely ground bone black mixed with a good quality of furniture varnish answers very well for these purposes.

(9) J. S. inquires how to make rouge for polishing purposes. A. Take crystals of sulphate of iron (green vitriol or copperas), have them as clean as possible; and put them into crucibles or cast iron pots and expose them to heat, without suffering the smallest particles of dust to get in, which would have a tendency to scratch the articles to be polished. Those portions which are least calcined, and are of scarlet color, are fit to make rouge for polishing gold or silver; while those which are more calcined, or have become red, purple, or bluish purple, form crocus fit for polishing brass or steel.

### COMMUNICATIONS RECEIVED.

On the Figure 9. By G. C.

A Suggestion to inventors. By L. N. D.

On a New System of Weights and Measures. By D. B.

On the Telephone Under Water. By S. B.

On Boiler Explosions. By S. B.

[OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the Week Ending**

**December 16, 1879,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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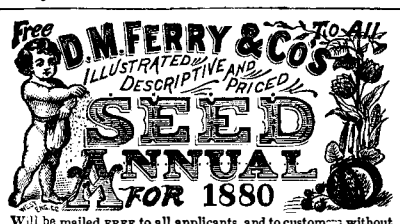


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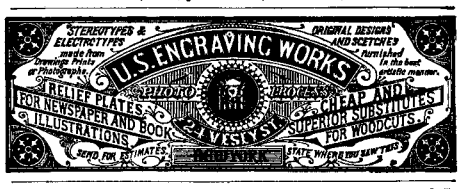
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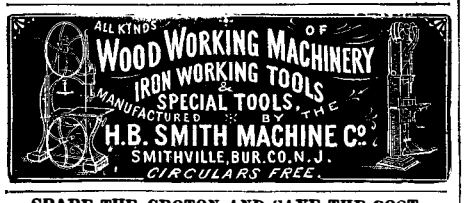


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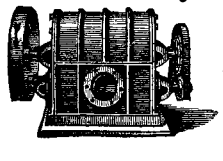

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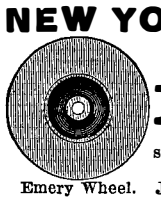

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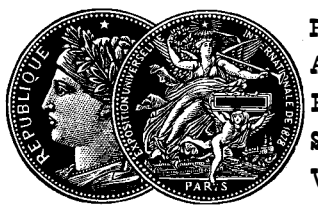


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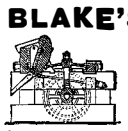

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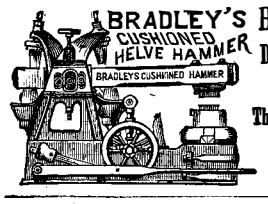


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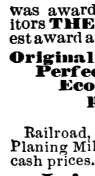

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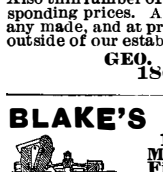


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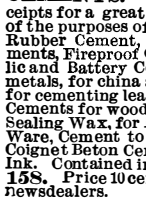

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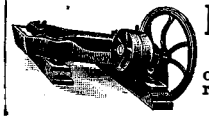

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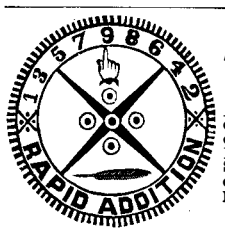


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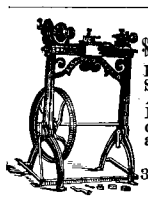

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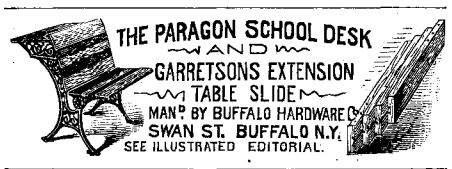


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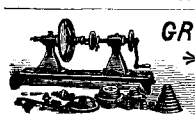

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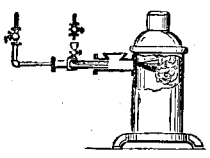

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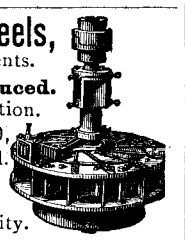

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